

# The ISCRAM Future Threat Delphi: Nostradamus Revisited

by

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## Abstract

During a 5 month period from November 2011 to March 2012, 36 professionals participated in an exploratory two-round Delphi to develop a list of 86 threats in 11 categories important for the next decade which they felt were not now receiving adequate planning or adequate development of mitigation options. This involved 14 academics studying Emergency Preparedness and Management, eight practitioners in Emergency Management, and 14 professionals in other related fields. A list of those involved is provided, excluding those participants who requested anonymity. The second round included a rating of all the threats developed on the first round. As a result, of the rating, a significant number of threats were classified as having a strong consensus for being extremely or very important. Another significant number of threats were identified as requiring further investigation to remove possible uncertainties and disagreements among the participants. There was, surprisingly, only one item in all the threats for which there was a statistical significant difference in the way the EM practitioners and the other two categories of participants voted. A follow on effort is being planned which will involve open online discussions to explore and expand on this initial effort.

**Keywords:** Threats, disasters, catastrophes, emergencies, Delphi, planning, mitigation, emergency preparedness, emergency management, business continuity

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## Introduction

Beginning in mid October 2011 the first round of a Delphi was sent out to a limited number of practitioners and academics working in the Emergency Preparedness and Management Areas. The approach was to use a "snowball" sample where the participants were asked to suggest other professionals who might be interested in responding. Every participant was asked to supply answers to two questions:

"Add three to five very important items to each of two questions:

1. **Very important** risks or threats that will be significantly possible in the future (i.e. within the next decade) and that are **not receiving adequate** attention or consideration today. These may range from a specific geographical area to a world wide situation. They may be man made, natural, or of uncertain origin.
2. Resulting actions, mitigations, research efforts, policies, decisions, investments etc. that are **very important** and **not being done** that are necessary to be able to deal with the risks or threats in 1..

Each item you contribute needs a short title and a paragraph definition (see examples).

Please invite from one to five other individuals whom you know well and feel would have interesting insights or additions to this survey. You may forward them this message and the survey attachment with your personal invitation. Please copy me on the forwarding message."

In the actual first round survey document, they were given only two examples:

**U.S. electrical blackouts:** Increasingly frequent large scale blackouts due to the unreliability of the U.S. national electrical distribution network.

Major U.S. infrastructure investment to modernize completely the U.S. electrical distribution network and a centralized industry-based control operation for handling emergencies.

**Increasing lack of available agricultural surpluses:** A growing inability to respond to major starvation situations on a worldwide basis.

Create major stockpiles of sealed emergency rations having at least a five year shelf life and no need of temperature control for storage or use in starvation emergencies.

The results were 86 potentially important threats submitted by 26 contributors. They were grouped into 11 different categories. It took about 60 invitations to get this many contributors. The distribution of the threats by category is indicated in the following table followed by the page where the list of all threats in a given category begins.

<b>Categories formed from Round 1 response</b>	<b>Number Of Items</b>	<b>Page for list of all</b>
<b>1. Climate Based</b>	<b>5</b>	<b>16</b>
<b>2. Commercial and Infrastructure Oriented</b>	<b>5</b>	<b>18</b>
<b>3. Complexity of Systems Oriented</b>	<b>8</b>	<b>20</b>
<b>4. Environmental and Pollution Related</b>	<b>4</b>	<b>23</b>
<b>5. Human Behavior Related</b>	<b>22</b>	<b>25</b>
<b>6. Human Induced</b>	<b>14</b>	<b>31</b>
<b>7. Information Warfare</b>	<b>5</b>	<b>35</b>
<b>8. Physical Warfare</b>	<b>5</b>	<b>37</b>
<b>9. Public Health Related</b>	<b>5</b>	<b>39</b>
<b>10. Terrorism</b>	<b>6</b>	<b>41</b>
<b>11. Major Disasters and Catastrophes</b>	<b>7</b>	<b>43</b>
<b>Total</b>	<b>86</b>	

Table 1. Categories with Number of Event Items

The number and diversity of the threat list were quite a surprise and it was clear we could not carry out, at that time, further investigation of the second category of actual mitigation options, actions, and policies that might prove useful in an unfunded volunteer effort. Therefore, we restricted the second round to only asking for the rating of the importance of each of the 86 threats. Besides titles, participants did provide definitions and some mitigation options on the first round. The summary of all threats section provided in the second round contains the definitions and the options that the participants provided. In some cases where more than one person suggested a given threat, the definition provided in the summary is a composite of the different first-round suggestions when there was a slight difference in emphasis. Otherwise, the wordings of the participants did not receive any direct content editing. A few items exhibited some political bias and this might be edited for any follow on effort. It is also clear that "economic and financial disasters" contained in category 5 should be moved to a separate twelfth category in any follow on work.

It was, and still is, our intention to put the results of this online for further investigation of the possible mitigation policies and actions as well as additional threats. This would be open to professionals and to concerned citizens who want to explore planning and preparedness in their own local areas as well as nationally or internationally. This first step follows a tradition in the Delphi and Computer Mediated Communications area (Linstone and Turoff, 1975; Hiltz and Turoff, 1978, 1993; Van de Walle, Turoff, and Hiltz, 2010). The initial Delphi effort is usually oriented to exploring a given area to gather all the possible options that should be included in further analysis and typically requires two rounds.

The second round was sent out from late November through mid January 2012. It was focused upon voting on the Importance of the resulting 86 items using a single scale of importance that combined the potential damage with the feasibility of mitigation. We felt that trying to use two independent scales would prove to be too big an effort for active

and quick responses. We added additional respondents and had 36 responses to the second round voting. The instructions that the respondents were given for voting were:

The non-linear ordered categorical scale (1 to 5) for the importance of doing planning and mitigation for a given event has two dimensions. A threat is extremely important if it is the direct cause of extremely significant negative consequences and a great deal of effective planning and mitigation is possible. It is unimportant if nothing can be done by planning and mitigation to reduce effectively the negative impacts. For example, a super volcano would be unimportant on that scale. Each scale value has qualitative definitions in the ballot attachment explanation. In Delphi processes we ask that if you are not confident in your vote on an item, do not vote for that item, leave it blank. In future rounds (see reflections); you might feel more confident because of the added comments and explanations of others for their particular views.

Note that in the Delphi process we ask respondents to vote only on the items about which they feel confident. In terms of the 86 items, the highest number of votes was 33 out of a possible 36, and in some cases, the total number of votes was only in the mid 20's. In a complete Delphi process, we would have explored reasons for the lack of consensus on some items resulting in a flat or spread distribution of votes, hinting at uncertainties, and even a few polarized distributions hinting and disagreements. In the section on results, the highest importance consensus items and the spread distribution items are identified (i.e. maximum standard deviation). Ultimately, a follow on effort would allow voters to identify the reasons and rationales for their votes which could be investigated by voting on relevance and truthfulness and voters on the original threats could easily change their votes. The investigation of potential planning actions and mitigation actions would also follow on for the most important threats. Successful Delphis, usually taking four to five rounds (or online continuous ones over a number of months), and typically exhibit a 20 to 30% changes of votes (Turoff, 2009; Linstone and Turoff, 1979, 2010).

One may consider this effort a first step in a much larger collaborative project that would ultimately improve collaborative transparent planning for any particular threat of concern to those individuals and organizations both responsible and impacted by the given threat (Turoff and Hiltz, 2009, 2008; Bañuls and Turoff, 2011, 2012).

In the next section, we summarize a rank order of the most important threats as voted upon in the second round, and then list the threats that exhibit high uncertainty or disagreement among the votes, based upon the standard deviation of the judgments.

A Delphi is only as good as the people who contribute to it. They need to be knowledgeable about the topic. We were very fortunate to have a good representative group of practitioners and academics which is very important for this effort. We also had good multidisciplinary representation of related professional fields. We started with people we knew well and asked them to suggest other participants who we added in the process. Usually one wants 3 to 5 persons in any knowledge area needed to cover the complexity of the problem. If a lot of disagreement is expected, five is the preferable

minimum number to allow meaningful minority views and avoid the Asch effect. Also, for open ended exploration of a broad topic such as this one, a large number is desirable to uncover new perspectives.

The list of the thirty-six participants is comprised of:

- 14 academics who have worked in emergency preparedness and management
- 8 practitioners in EP&M
- 14 professionals in related fields like auditing, security, risk analyses, etc.

Five of the participants choose to remain anonymous. Three of those worked for government agencies.

One of the unfortunate realities of this field is that there is no real free exchange of ideas among many professionals because organizations do not want to admit to mistakes and make public what they are doing to avoid those mistakes in the future. Even though it is a fundamental theory of proper emergency management that the exposure of mistakes and their correction is necessary to prevent worse mistakes in the future (Turoff, 2008)

Type	Participant
1-other	Robert Baksa, Auditor, Finance, Business, NJIT PhD student
2-academic	Víctor Amadeo Bañuls Silvera, EM Researcher, Associate Professor, Universidad Pablo de Olavide, Sevilla, Spain, Departamento de Dirección de Empresas
3-other	Kirke Bent, Electronic Systems Security, Retired Vice President for systems security, Retired from Prudential Financial
4-other	Joan B Berkowitz, Environmental industry, Managing Director, Adjunct Professor, Farkas Berkowitz & Company, University of Maryland, University College
5-academic	José Miguel Castillo Chamorro, PhD, EM researcher, Tecnalía, Spain
6-academic	Rui Chen, EM Researcher, Assistant Professor, Ball State University
7-practioner	Steven C. Davis, Former Fire/EMS, EM practitioner as a consultant, President, All Hands Consulting
8-academic	Magiswary Dorasamy, EM researcher, PhD student, Senior Lecturer, Multimedia University, Malaysia
9-academic	Julie Dugdale, PhD, EM Researcher, Grenoble Informatics Lab/Grenoble University
10-academic	Simon French, Academic and Researcher on decision and risk analysis, director of the Risk Initiative and Statistical Consultancy Unit, University of Warwick
11-other	Paul Oortman Gerlings, Risk and incident analyst, Risk policy adviser, CERN ( <u>European Laboratory</u> )
12-other	Dr. Radu Gheorghiu, Foresight practitioner, Information society researcher, Senior researcher, PhD, Institute for World Economy, Bucharest

13-academic	Jose J Gonzalez, EM researcher, Academic, Professor. University of Agder, Norway
14-other	Jeremy Hutchings, Conservation practitioner, heritage science, sustainability, Associate Professor, IAKH, University of Oslo
15-other	Betty K. Jensen, Physicist: areas of expertise: nuclear energy, environment, Adjunct Professor, University of Maryland, University College
16-other	Richard A. Jensen, Safety and Energy Engineer, Associate Professor, Hofstra University
17-other	Irene Anne Jillson, PhD, EM researcher , Assistant Professor in Nursing, Georgetown University
18-practitioner	Martin Kaufman, Strategic Foresight for EM Community; Long Range Planning, Federal Consulting, Managing Director, Hassett Willis & Company
19-other	Dr. Vahid Khodakarami, Researcher, Bu Ali Sina University, Hamedan, Iran
20-academic	Leysia Palen, Technology-Abetted Citizen Participation Behavior, Associate Professor, University of Colorado Boulder
21-other	Harold Linstone, Management scientist, technological forecasting, systems science, University Professor Emeritus of Systems Science, Portland State University
22-practitioner	Dr. Alvaro Pemartin, Emergency Physician, EM Practitioner, Consultant, IAEM Europa
23 academic	Linda Plotnick, Researcher, Assistant Professor, Jacksonville State University
24-practitioner	Lawrence Province, EM Practitioner, Safety Manager, Retired, University of Central Missouri, Johnson County LEPC
25-academic	Dr. Murali Raman , EM researcher, Associate Professor, Multimedia University Malaysia
26-academic	Yixing Shan, EM researcher, Research Student, School of Business and Economics, Loughborough University, UK
27-practitioner	Rick Tobin, EM Practitioner, President/CEO, TAO Emergency Management Consulting
28-other	Miklos A Vasarhelyi, Continuous Audit/monitoring, Professor, Rutgers University
29-academic	Sarah Vieweg, Crisis Informatics Researcher, Research Assistant, PhD student, University of Colorado, Boulder
30-practitioner	Hans Zimmermann, Practitioner with field experience, Senior Coordination Officer, United Nations (retired), Consultant
31-academic	Dr. Marian Zulean, EM researcher, University of Bucharest
	<b>Anonymous Participants</b>
32-other	Academic, China
33-other	Entrepreneur, Economic Systems, member of Noosphere
34-practitioner	Practitioner, City government employee
35-practitioner	Practitioner, State government employee
36-practitioner	Practitioner, Federal government Employee

## Summary of Significant Threat Items

We present in this section the top 20 items in ranked order of importance and also the 23 items having the widest standard distribution out of the total of 86 items. The scale the voters used was the following:

### Importance (Priority or Relevance) Scale for Planning, Preparedness, or Mitigation

#### 1. Extremely Important

- An extremely relevant item
- First order priority
- Planning can have a great deal of impact
- It must receive much more attention

#### 2. Very Important

- A most relevant item
- Second order priority
- Planning has direct bearing and/or impact
- Must be dealt with or treated more

#### 3. Important

- Is relevant
- Third order priority
- Planning has significant impact but less than other items
- Does not have to or cannot be completely dealt with

#### 4. Slightly Important

- Insignificantly relevant
- Fourth order priority
- Planning has only a little meaningful impact
- There is not much possible that can be done

#### 5. Unimportant

- Not relevant to meaningful planning
- No meaningful priority
- No impact possible
- Nothing effective that can be done

**X or blank if you feel you cannot make a judgment on this item**

Note this single scale incorporates two separate dimensions.

1. The actual importance of the threat event being able to create damage
2. Whether or not any more planning or mitigation actions can be taken to reduce the threat

One might say it is a diagonal measurement between the importance dimensions (because of the amount of damage it can do) and the feasibility of planning, preparedness, and actions to mitigate that damage.

We show below how the 86 threat items were distributed by the total number of votes making up the two top categories: **the extremely important plus the very important.**

We then list the 20 top rated items using this method. All the items are organized by the 11 categories, with the full statistics for each event and the comments of the respondents in defining and suggesting mitigation considerations in the Detailed Results section.

Table 2 shows the items that received the number of votes listed in the “Total Votes” column, which ranges from a high of 23 to a low of only 3 total votes in the first two categories. The “Count of Items” column enumerates the number of events listed in the “Items” column on that row.

Total Votes	Items	Count of Items
<b>23</b>	7.3	1
<b>22</b>	7.2	1
<b>21</b>	5.1, 5.8, 6.2	3
<b>20</b>	1.2, 6.9, 7.1	3
<b>19</b>	8.1	1
<b>18</b>	1.1, 5.13, 10.1, 10.2	4
<b>17</b>	2.4, 7.5, 10.4	3
<b>16</b>	1.5, 9.3, 9.5, 11.5	4
15	2.1, 2.5, 3.1, 4.2 5.10, 5.14, 5.16, 6.12, 9.1, 9.2, 10.5, 11.7,	12
14	1.3, 1.4, 4.1, 5.4, 6.8,10.6	6
13	5.3, 6.13, 11.6	3
12	3.4, 4.3, 5.5, 6.3, 6.4, 7.4	6
11	5.6, 5.7, 5.15,	3
10	6.6, 6.14, 8.4, 8.5, 9.4, 11.2, 11.4	7
9	3.2, 3.8, 5.11, 8.3, 11.3	5
8	3.3, 3.6, 4.4, 5.17, 5.22, 6.7, 6.10, 10.3	8
7	2.2, 2.3, 5.2, 5.9, 5.20, 5.21, 6.5, 8.2, 11.1	9
6	5.18, 5.19	2
5	6.1, 5.12	2
4	3.5	1
3	3.7,6.11	2
<b>Total</b>		<b>86</b>

Table 2: Count of Extremely + Very Important votes

We have listed the top items below (List 1) which are those for which the vote count in the first important categories is approximately 50% or more of the vote or a Median of 2.00 or better. While there are 36 possible votes, it is hardly ever more than 32 and often less, frequently ranging in the mid to high 20's. The vote count serves to give a ranked order for the 20 most important events is follows:



**List 1: Events with highest mean and a majority of participant voters**

**Rank 1: Event 7.3 Disruption of electrical power**

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.05
Raw	14	9	7	1	1	32	Mean=1.94
%	38.9	25.0	19.4	2.8	2.8	88.9	Median=2.00

**Rank 2: Event 7.2 Disruption of essential information services**

Votes	Extremely	Very	Important	Slightly	None	Total	SD=.946
Raw	8	14	10	1	1	34	Mean=2.21
%	22.2	38.9	27.8	2.8	2.8	94.4	Median=2.00

**Rank 3: Event 5.1 Population growth**

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.31
Raw	9	12	6	4	4	35	Mean=2.49
%	25.0	33.3	26.7	11.1	11.1	97.2	Median=2.00

**Rank 4: Event 5.8 Reoccurring financial crisis or a true major recession**

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.09
Raw	7	14	7	2	2	32	Mean=2.31
%	19.4	38.9	19.4	5.6	5.6	88.9	Median=2.00

**Rank 5: Event 6.2 Deforestation**

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.30
Raw	10	11	2	6	2	31	Mean=2.32
%	27.8	30.6	5.6	16.7	5.6	86.1	Median=2.00

**Rank 6: Event 1.2 Tornadoes and floods**

Votes	Extremely	Very	Important	Slightly	None	Total	SD=.92
Raw	9	11	8	2	0	30	Mean=2.10
%	25.0	30.6	22.2	5.6	0	83.3	Median=2.00

**Rank 7: Event 6.9 Critical Infrastructure breakdowns due to aging**

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.14
Raw	10	10	10	2	2	34	Mean=2.20
%	27.8	27.8	27.8	5.6	5.6	94.4	Median=2.00

**Rank 8: Event 7.1 Vulnerability of cyber infrastructure**

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.08
Raw	13	7	9	4	0	33	Mean=2.12
%	36.1	19.4	25.0	11.1	0	91.7	Median=2.00

**Rank 9: Event 8.1 Open conflict between two leading countries of the world**

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.30
Raw	6	13	4	2	4	29	Mean=2.48
%	16.7	38.1	11.1	5.6	11.1	80.6	Median=2.00

**Rank 10: Event 1.1 Increasing frequency and severity of extreme climate events**

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.08
Raw	12	6	11	4	0	33	Mean=2.21
%	33.3	16.7	30.6	11.1	0	91.7	Median=2.00

**Rank 11: Event 5.13 Collapse of the international financial system**

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.13
Raw	8	10	8	5	1	32	Mean=2.41
%	22.2	27.8	22.2	13.9	2.8	88.9	Median=2.00

**Rank 12: Event 10.1 Attacks on major special events**

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.19
Raw	11	7	7	4	1	30	Mean=2.23
%	30.8	19.4	19.4	11.1	2.8	83.3	Median=2.00

**Rank 13: Event 10.2 Pandemics, viruses' insertion**

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.21
Raw	11	7	6	4	1	29	Mean=2.21
%	30.6	19.4	16.7	11.1	2.8	80.6	Median=2.00

**Rank 14: Event 2.4 Electrical Grid**

Votes	Extremely	Very	Important	Slightly	None	Total	SD=.95
Raw	7	10	10	3	0	8.3	Mean=2.30
%	19.4	27.8	27.8	8.3	0	83.3	Median=2.00

**Rank 15: Event 7.5 Stuxnet type worm attacks on real time control systems**

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.22
Raw	8	9	6	3	2	28	Mean=2.36
%	22.2	25.0	16.7	8.3	5.6	77.8	Median=2.00

**Rank 16: Event 10.4 Terrorist threat to the water supply of a major city**

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.29
Raw	10	7	7	5	2	31	Mean=2.42
%	27.8	19.4	19.4	13.9	5.6	86.1	Median=2.00

**Rank 17: Event 1.5 Extreme weather making power outages more common and extensive**

Votes	Extremely	Very	Important	Slightly	None	Total	SD=.96
Raw	2	14	7	4	1	28	Mean=2.57
%	5.6	38.9	19.4	11.1	2.8	77.8	Median=2.00

**Rank 18: Event 9.3 Pandemic Flu**

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.22
Raw	8	8	7	8	1	32	Mean=2.56
%	22.2	22.2	19.4	22.2	2.8	88.9	Median=2.50

**Rank 19: Event 9.5 Lack of water treatment facilities**

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.20
Raw	7	9	8	4	2	30	Mean=2.50
%	19.4	25.0	22.2	11.1	5.6	83.3	Median=2.00

**Rank 20: Event 11.5 Threat of weather/seismic event driven cross-border mass migration**

<b>Votes</b>	<b>Extremely</b>	<b>Very</b>	<b>Important</b>	<b>Slightly</b>	<b>None</b>	<b>Total</b>	<b>SD=1.19</b>
<b>Raw</b>	<b>3</b>	<b>13</b>	<b>5</b>	<b>5</b>	<b>3</b>	<b>29</b>	<b>Mean=2.72</b>
<b>%</b>	<b>8.3</b>	<b>36.1</b>	<b>13.9</b>	<b>13.9</b>	<b>8.3</b>	<b>80.6</b>	<b>Median=2.00</b>

The following table (Table 3) shows the maximum standard deviations calculated at 1.26 up to 1.44. Items with a high standard deviation point to threat items for which there is a lot of uncertainty among the respondents which may be caused by a variety of factors:

1. There are uncertainties about which some members might have interesting comments to help resolve.
2. There may be actual disagreements about these individual items that in some cases lead to a polarized distribution.
3. There may be different interpretations being made about what the real nature of the event is.

Only by doing an additional two rounds could we have solicited these underlying factors and asked people to vote on their validity and use the result of that to have them vote on the validity of these comments and then, as a result of seeing that, we could have then asked people to revote on the importance scale. However, when we reached 86 events we felt strongly that these added undertakings could only be done effectively in an online Delphi type environment that should be open to a larger number of participants. In fact, it should be designed as an open continuous process supporting specific planning operations.

SD	Threat Number	Count of items
1.44	5.19	1
1.38	5.4	1
1.35	8.3	1
1.34	3.3, 11.4	2
1.33	6.13	1
1.32	5.10	1
1.31	4.4, 5.1, 5.15, 9.1, 11.7	5
1.30	6.2, 8.1	2
1.29	9.2, 10.4, 10.6	3
1.28	5.2, 5.6	2
1.27	6.3, 9.4	2
1.26	1.4, 5.9	2
<b>Total</b>		<b>23</b>

Table 3: Spread distributions indicating uncertainty and/or disagreement

List 2 below is of the 23 events with a standard deviation of +-1.26 or higher on the 5 points scale (distance of 4) being used. This is approximately 2.52/4.0 of the scale or 63% of the scale.

**List 2: Events with the largest standard deviations.** (Note that three of these appear in both List 1 and List 2 and are indicated by an \*)

**Rank 1: Event 5.19 Growing inconsistencies in the U.S. Judicial Process**

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.44
Raw	3	3	3	6	7	22	Mean=3.50
%	8.3	8.3	8.3	16.7	19.4	61.1	Median=4.00

**Rank 2: Event 5.4 Citizen Revolts**

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.38
Raw	3	11	9	5	3	31	Mean=2.81
%	8.3	30.6	25.0	13.9	8.3	86.1	Median=3.00

**Rank 3: Event 8.3 Civil war in China possibly involving Japan and Taiwan**

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.35
Raw	4	5	7	5	5	26	Mean=3.08
%	11.1	13.9	19.4	13.9	23.9	72.2	Median=3.00

**Rank 4: Event 3.3 Ubiquitous Federal and State resources create a culture of dependence**

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.34
Raw	3	5	4	8	5	25	Mean=3.28
%	8.3	13.9	11.1	22.2	13.9	69.4	Median=4.00

**Rank 5: Event 11.4 A Volcano eruption of a size having world-wide effects**

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.34
Raw	3	7	9	2	7	28	Mean=3.11
%	8.3	19.4	25.0	5.6	19.4	77.8	Median=3.00

**Rank 6: Event 6.13 Increasing severity of natural disasters owing to overpopulation:**

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.33
Raw	7	6	11	4	5	33	Mean=2.82
%	19.4	16.7	30.6	11.1	13.9	91.7	Median=3.00

**Rank 7: Event 5.10 Overfishing in the oceans**

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.32
Raw	6	9	9	3	5	32	Mean=2.75
%	16.7	25.0	25.0	8.3	13.9	88.9	Median=3.00

**Rank 8: Event 4.4 Moving garbage to developing countries increases pollution**

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.31
Raw	3	5	8	6	7	29	Mean=3.31
%	8.3	13.9	22.2	16.7	19.4	80.6	Median=3.00

**Rank 9: Event 5.1 \*Population growth**

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.31
Raw	9	12	6	4	4	35	Mean=2.49
%	25.0	33.3	26.7	11.1	11.1	97.2	Median=2.00

**Rank 10: Event 5.15 Growing political instability in Western democracies**

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.31
Raw	2	9	7	4	7	29	Mean=3.17
%	5.6	25.0	19.4	11.1	19.4	80.6	Median=3.00

**Rank 11: Event 9.1 Maintaining a healthy population**

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.31
Raw	7	8	9	4	4	32	Mean=2.69
%	19.4	22.2	25.0	11.1	11.1	88.9	Median=3.00

**Rank 12: Event 11.7 Mega disasters**

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.31
Raw	8	7	8	5	3	31	Mean=2.61
%	22.2	19.4	22.2	13.9	8.3	86.1	Median=3.00

**Rank 13: Event 6.2 \*Deforestation**

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.30
Raw	10	11	2	6	2	31	Mean=2.32
%	27.8	30.6	5.6	16.7	5.6	86.1	Median=2.00

**Rank 14: Event 8.1 \*Open conflict between two leading countries of the world**

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.30
Raw	6	13	4	2	4	29	Mean=2.48
%	16.7	38.1	11.1	5.6	11.1	80.6	Median=2.00

**Rank 15: Event 9.2 Food security**

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.29
Raw	12	3	11	4	2	32	Mean=2.41
%	33.3	8.3	30.6	11.1	5.6	88.9	Median=3.00

**Rank 16: Event 10.4 \*Terrorist threat to the water supply of a major city**

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.29
Raw	10	7	7	5	2	31	Mean=2.42
%	27.8	19.4	19.4	13.9	5.6	86.1	Median=2.00

**Rank 17: Event 10.6 Dirty Bombs are far more likely in the next decade**

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.29
Raw	7	7	6	6	2	28	Mean=2.61
%	19.4	19.4	16.7	16.7	5.6	77.8	Median=2.50

**Rank 18: Event 5.2 Unwillingness to accept the need for change**

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.28
Raw	3	4	11	5	8	31	Mean=3.35
%	8.3	11.1	30.6	13.9	22.2	86.1	Median=3.00

**Rank 19: Event 5.6 Totalitarian ideologies**

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.28
Raw	3	8	11	3	7	32	Mean=3.09
%	8.3	22.2	30.8	8.3	19.4	88.9	Median=3.00

**Rank 20: Event 6.3 Waste water injection into the earth**

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.27
Raw	4	8	6	5	3	26	Mean=2.81
%	11.1	22.2	16.7	13.9	8.3	72.2	Median=3.00

**Rank 21: Event 9.4 Radioactivity**

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.27
Raw	4	6	9	7	5	31	Mean=3.10
%	11.1	16.7	25.0	19.4	13.9	86.1	Median=3.00

**Rank 22: Event 5.9 Increase in meat consumption**

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.26
Raw	2	5	6	9	9	31	Mean=3.58
%	5.6	13.9	16.7	25.0	25.0	88.1	Median=4.00

**Rank 23: Event 1.4 Climate Warming**

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.26
Raw	8	6	11	4	3	32	Mean=2.63
%	22.2	16.7	30.6	11.1	8.3	88.9	Median=3.00

The distribution of the total vote is presented in the following table (Table 4). We believe it indicates the careful choice of the respondents to vote on the items for which they felt they could present some insight. Note that no event had votes from all participants. Shown is the number of threats voted on by individual voters out of a total possible of 36 votes.

Total Votes	Number of voters
35	1
34	2
33	3
32	11
31	13
30	16
29	13
28	9
27	2
26	8
25	3
24	1
23	1
22	2
Total	86

Table 4. Distribution of Votes

The resulting average is 28.7 votes for each of the 86 items by the 36 voters. The threat items with the lower number of votes tend to be those with the largest standard deviations.

The next section provides the statistics on all the 86 items organized by the categories. It also provides the text that various people used to define the individual events and some suggestions of possible mitigation actions. In many cases, the definitions are a composite of the wordings contributed by a number of different participants trying to describe the same problem.

One must also note that even though most of the respondents were very much involved in traditional emergency management, they were quite concerned with the impacts of problems of human, governmental, and organizational behavior that underlies a lot of difficulties having to do with effective response. There were 36 threats introduced under categories 5 and 6 (Human Behavior Related and Human Induced). One of the most interesting is "6.14 Perverse consequences" such as failure of insurers to payout on losses or going bankrupt. It also results from the use of very old national maps (1970 in the U.S.) to depict flood plains. The result was that many people did not have flood insurance but still lost their homes in Katrina. A similar item was:

### **3.5 The changing role of the individual leaves more people outside the preparedness envelope**

This includes the lack of planning for immigrants, assorted disabilities, and poverty conditions, etc. The lack of governmental planning or anticipation at any level for response or recovery does often lead to serious consequences that are usually not perceived till much later and for which little is done.

## Summary of All Threats produced by the ISCRAM Delphi

In the following, we show the threats produced in the first round and the statistics of the resulting vote of importance. This includes the raw vote count, the percentage distribution of each point on the scale, the Mean, Median, and the Standard deviation. They are arranged by category and the id number used in the Delphi process. When available for an event, suggestions for mitigation provided by participants are listed below the event statistics.

### 1. Climate Based

#### 1.1 Increasing frequency and severity of extreme climate events

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.08
Raw	12	6	11	4	0	33	Mean=2.21
%	33.3	16.7	30.6	11.1	0	91.7	Median=2.00

Climate change poses "an immediate, growing, and grave threat" to health and security around the world. Research suggests that increasing global mean temperatures is causing an increase in the frequency and magnitude of many extreme climate events. If this trend continues, over the next decade what has now been referred to as "Global weirding" will have a major impact on demographics, population displacement, and food production. It can also cause disruption/damage to infrastructure, supply chains, etc. (e.g. direct hit of a level 5 hurricane on New York City).

Insurance statistics show a steady increase in extreme weather (floods, storms, droughts, heat waves, cold waves, etc) the past decades. Although most of these events are physically rather local in effect, larger technology-density and globalization have made the consequences of such events a lot more far reaching. Whether caused by a weather cycle or human-caused, climate change is in process and the resulting instabilities as the system seeks a new stable configuration are increasing the frequency of severe weather occurrences.

1.1.1 There are few short-term fixes to this problem. In the longer term, it will be necessary to reduce the factors that are now widely recognized as the cause of the problem: anthropogenic carbon dioxide, pollution, etc

1.1.2 The most pressing need is for increased investment in research.

1.1.3 Ensure that there is a government enforced minimal standard for continuity of operational plans with failover facilities (facilities able to recover automatically from a shut down or error condition) that are sufficient distance from primary site to ensure back up facilities survive.

1.1.4 Develop technologies to reduce oil and gas dependency to reduce CO2 emissions.

1.1.5 Develop technologies to prepare (collectively) for bad weather (civil works, preferably small local scale solutions)

1.1.6 Research to identify trends and improve forecasts

1.1.7 Better preparedness and mitigation is a key to success. Build better buildings, avoid hazard zones, the normal approaches work, we just need to get more serious about it.



1.1.8 Our U.S. response system is actually in pretty good shape but budget cuts are hurting the entire EM cycle.

1.1.9 Many countries have to improve their mitigation standards and their preparedness status for avoiding the more serious consequences from natural disasters.

1.1.10 Improve national, regional, and local plans to counter against the growing proliferation of floods, droughts, and strong winds of all types.

1.1.11 Reduce population growth.

## 1.2 Tornados and floods

Votes	Extremely	Very	Important	Slightly	None	Total	SD=.92
Raw	9	11	8	2	0	30	Mean=2.10
%	25.0	30.6	22.2	5.6	0	83.3	Median=2.00

As seen across the country (U.S.) this past year, flooding and tornados have been devastating.

1.2.1 Increased use of CASA weather devices. These pick up disturbances at much lower heights than current devices, identifying tornados and heavy rain.

## 1.3 Drought in the U.S.

Votes	Extremely	Very	Important	Slightly	None	Total	SD=.95
Raw	8	6	8	1	0	23	Mean=2.09
%	22.2	16.7	22.2	2.8	0	63.9	Median=2.00

The southern states have seen an incredible drought this year that brings heavy wildfires and affects agriculture and water supplies. Drought also causes conflicts in the use of water which are settled in court by decisions that may not be optimal. There is also the potential for wide scale disruption of water availability due to disputes over water rights.

1.3.1 We need more secure water usage plans put into place.

1.3.2 Firefighters in these areas need more direct funding to help them be ready.

1.3.3 Development of a national water rights policy and increased regulation of private water providers

## 1.4 Climate Warming

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.26
Raw	8	6	11	4	3	32	Mean=2.63
%	22.2	16.7	30.6	11.1	8.3	88.9	Median=3.00

Increasing temperatures, climate alterations which affect ecosystems – changes in agriculture, changes in naturally occurring flora and fauna, occurrence of animal and plant extinction. Increased melting of land based glaciers will raise water levels significantly by 2050.

1.4.1 Education, many have a first-hand awareness of climate change due to inability to grow crops, experiencing drought, etc.

1.4.2 Create more awareness of this empirical evidence that globally, temperatures are rising and things are changing in the environment

### 1.5 Extreme weather making power outages more common and extensive

Votes	Extremely	Very	Important	Slightly	None	Total	SD=.96
Raw	2	14	7	4	1	28	Mean=2.57
%	5.6	38.9	19.4	11.1	2.8	77.8	Median=2.00

An unusually early snowstorm in the northeast of the United States (late October 2011) where many trees had not lost all their leaves caused major outages of power for up to a week for a great many. One suspects reductions in annual tree pruning for local power lines might have had a long term complication, through efforts to reduce costs for maintenance.

1.5.1 Increased maintenance of all weather sensitive infrastructures and associated costs becomes necessary.

## 2. Commercial and Infrastructure Oriented

### 2.1 Fossil Fuel Shortages

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.10
Raw	5	10	8	6	1	30	Mean=2.60
%	13.9	27.8	22.2	16.7	2.8	83.5	Median=2.50

Wide scale disruption of the availability of fossil fuels, such as oil, due to supply, conflict, and pricing; and coal due to technology and regulation. We have had severe ones in the past.

A shortage of oil due to conflict, embargo, or depletion of this natural resource (Peak Oil) may result in shortages over time. This may impact society and the global economy in numerous negative ways such as inflation, recession, and supply chain disruptions increasing human suffering and potentially leading to other cascading effects in the supply of critical items like food and medicine.

2.1.1 Development of a national-level fuel prioritization system

2.1.2 Development of alternative technologies

2.1.3 Increase stockpiles in industry and by state and national governments.

2.1.4 Obviously alternative fuels and energy sources are needed along with great efficiency and less dependence on internal combustion engines

2.1.5 Much more specific contingency plans need to be made. Based on what happens when the gas stations lose power this has the potential to get ugly.

Expectation management will be a key factor.

## 2.2 Solar Storms

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.11
Raw	3	4	10	7	2	26	Mean=3.04
%	8.3	11.1	27.8	19.4	5.6	72.2	Median=3.00

Solar activity is peaking in the near term. We are much more interconnected and dependant on electronics than we were at the last solar activity peak. Blackouts and loss of other electronics including resulting EMP effects on satellites are possible.

2.2.1 The infrastructure needs to be hardened and interconnectedness needs to be better managed.

2.2.2 Having alternatives ready to use would produce better contingency plans.

## 2.3 Loss of GPS system

Votes	Extremely	Very	Important	Slightly	None	Total	SD=.86
Raw	0	7	14	6	2	29	Mean=3.10
%	0	19.4	38.9	16.7	5.6	80.6	Median=3.00

When the GPS system was taken down in a small area of the North Sea for a NATO exercise, there were problems for several fishing fleets and commercial shipping. On land local deliveries are timed and managed on the assumption of a working SatNavs. More and more systems are becoming location aware. So losing the GPS would have significant effects

2.3.1 An alternative European System is being launched and will offer resilience in the median term. In the short term, large solar storms could be a problem.

## 2.4 Electrical Grid

Votes	Extremely	Very	Important	Slightly	None	Total	SD=.95
Raw	7	10	10	3	0	30	Mean=2.30
%	19.4	27.8	27.8	8.3	0	83.3	Median=2.00

Transmission of electricity from one part of the country to another reduces costs, and generally enhances reliability. However, it also increases system vulnerability. All too often, when the grid experiences a problem in one part of the country, the grid is affected in a significantly larger part of the country.

2.4.1 More effective and rapid means of isolating portions of the grid from one another need to be implemented.

## 2.5 Globalization and excessive dependence on one source

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.14
Raw	8	7	13	2	2	32	Mean=2.47
%	22.2	19.4	36.1	5.6	5.6	88.9	Median=3.00

Due to globalization, we have become much too dependent on one supply source for many items. Any disturbance in that supply chain (natural, social, or political) can cause havoc.

2.5.1 We need to broaden our source base for all essential materials.

### 3. Complexity of Systems Oriented

#### 3.1 Supply chain failures and instability of primary commodities

Votes	Extremely	Very	Important	Slightly	None	Total	SD=.95
Raw	2	13	5	6	0	26	Mean=2.58
%	5.6	36.1	23.9	16.7	0	72.2	Median=2.00

The margins of supply of primary commodities (basic food, sweet water, energy/oil+gas) have eroded the past decade (much to the benefit of the developing world!). In combination with social inequalities, extreme weather and/or terrorist attacks minor disruptions can have major impacts. Extreme coupling of components of supply chains making them very sensitive to small perturbations. Examples: food, fuels, medicines, finance, etc leading progressively from inconvenience, through deprivation, malnutrition, sickness, to deaths.

- 3.1.1 Develop buffers and alternative supply chains.
- 3.1.2 Nurture self supply (autarky).
- 3.1.3 Increase inventories for critical supplies

#### 3.2 Larger and more diverse urban areas

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.12
Raw	1	8	8	7	4	28	Mean=3.18
%	2.8	22.2	22.2	19.4	11.1	77.8	Median=3.00

Population migration to cities coupled with increased diversity makes planning and preparedness for disaster response/recovery more complex than current capabilities and models allow.

- 3.2.1 Leverage communication technology to accommodate multiple language preparedness messaging, enhance evacuation and shelter-in-place planning to address larger numbers, establish compacts with neighboring towns/states to be able to efficiently direct evacuation destinations.

#### 3.3 Ubiquitous Federal and State resources create a culture of dependence

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.34
Raw	3	5	4	8	5	25	Mean=3.28
%	8.3	13.9	11.1	22.2	13.9	69.4	Median=4.00

At its most basic, preparedness is a personal, community, and local activity. However, the creation of the National Preparedness Directorate (DHS/FEMA) and the billions of dollars spent on state/local “preparedness” through DHS grants has shifted expectations toward a more permanent federal and state preparedness function. This funding is already drying up and this is expected to escalate dramatically in the next few years.

- 3.3.1 Embed basic preparedness in elementary and secondary education (like anti-smoking, or duck and cover, etc.) so individual responsibility is re-established. Enhance and extend existing state-to-state cooperative agreements to create a more regional awareness and approach to resource sharing.

### 3.4 Interdependent systems leave large coastal urban areas vulnerable to “escalated catastrophes”

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.11
Raw	3	9	9	7	2	30	Mean=2.87
%	8.3	25.0	25.0	19.4	5.6	83.3	Median=3.00

So much of our world is interconnected (electricity, IT/Comms, water systems, transportation to name a few) that a blow to one system damages all others in a cascading manner, escalating local (or localized) disasters into national catastrophes. For example, a recent study (NYTimes, 10/26/2011, A22) for NY City projects a 7-12 inch rise of the sea level by 2050 and if rapid ice melting took place the rise could be 41 to 55 inches by 2080. Such ocean rises can cut off the delivery of fresh water (air intake vents flooded) and intern interfere with other buried infrastructures such as electricity and transit operations.

- 3.4.1 Joint planning across critical infrastructure and key resource categories.
- 3.4.2 Encourage redundant and/or ancillary logistics systems for response/recovery among these key sectors.
- 3.4.3 Formally study the key dependency among sectors and feed the results back to industry and the private sector. This is a business imperative and they will likely fund the right remediation.

### 3.5 The changing role of the individual leaves more people outside the preparedness envelope

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.11
Raw	1	3	11	6	7	28	Mean=3.54
%	2.8	8.3	30.6	16.7	19.4	77.8	Median=3.00

With more people living off the grid, or not trusting government and other official sources, an increasing number of citizens, visitors, and immigrants are not covered by existing and typical preparedness methods and planning. However, these populations are very present when disaster strikes and response and recovery are needed.

- 3.5.1 Reset expectations through preparedness programs (primary and secondary education as well as others) so people can either choose to participate in preparedness/awareness or remain ‘outside’ the planning envelope and fully understand the consequences.
- 3.5.2 Find unique ways to reach these opt-out populations with relevant messages about preparedness such as working through immigrant community leaders or online communities to communicate key preparedness information.

### 3.6 The unexpected will become more commonplace

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.20
Raw	2	6	8	8	5	29	Mean=3.28
%	5.6	16.7	22.2	22.2	13.9	80.6	Median=3.00

Long-cycle changes in things like climate, population centers, infrastructure degradation, environmental quality, etc. will combine to increase the frequency of unexpected events such as domestic terrorism, population unrest, intense storm events, etc.

3.6.1 Plan for the maximum of maximums and resource the preparedness, response, and recovery functions to assume fewer “off” times and more “on” times.

3.6.2 Collect and share metrics to support this trend with the public. The information on presidentially declared disasters, levels of preparedness, disaster damage costs, etc. are all available, and all very telling.

### 3.7 Cost optimizations by individual organizations may be suboptimum for society as a whole

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.06
Raw	1	2	9	6	4	22	Mean=3.45
%	2.8	5.6	25.04	16.7	11.1	61.1	Median=3.00

If each organization uses just in time delivery and highly efficient supply chains dependent on many unique single sources, any catastrophe or crisis could cause havoc.

3.7.1 We need to broaden our source base for all essential materials

3.7.2 Organizations should know who their real suppliers are and the risks associated with them.

### 3.8 Systemic Failure

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.05
Raw	4	5	11	3	1	24	Mean=2.67
%	11.1	13.9	30.6	8.3	2.8	66.7	Median=3.00

System failure(s) (of a very broad range of systems of systems) such as: disruption, loss of quality controls, component failure, degradation, diminishing flux (through-puts); due to operational factors such as: lack of redundancies, lack of network diversity, lack of maintenance, lack of monitoring and evaluations that lead to remedial actions, insufficient research and development, system architecture lacking evidence base. Obvious examples are electricity and telecommunication network failures, less obvious are biochemical failures including population inoculations with unforeseen long term consequences (e.g. Thalidomide), building failures (NZ’s “Leaky building syndrome”, North America’s insulated buildings entrapping and concentrating radon in basements), financial failures (becoming more common, e.g. USA, EU).

## 4. Environmental and Pollution Related

### 4.1 Radiation Contamination Events

Votes	Extremely	Very	Important	Slightly	None	Total	SD=.948
Raw	5	9	13	1	1	29	Mean=2.45
%	13.9	25.0	36.1	2.8	2.8	80.6	Median=3.00

The U.S. is not ready for incidents like the one in Japan.

4.1.1 We need much more planning, training, and exercising on these issues.

### 4.2 Nuclear waste proliferation vs. sustainable energy production

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.20
Raw	7	8	9	4	2	30	Mean=2.53
%	19.4	22.2	25.0	11.1	5.6	83.3	Median=2.50

The production of energy by using nuclear plants provides a big amount of nuclear waste. The way of getting rid of the nuclear waste is merely to bury it. Up to now, there is not a new sustainable source of energy that can substitute for nuclear plants. In the mean time, the nuclear waste stored in the surface of the earth is growing.

4.2.1 Develop new ways and technologies to get rid of nuclear waste.

4.2.2 Find a sustainable source of energy able to substitute efficiently the production of energy with nuclear plants.

### 4.3 Dependence on mono-crops and the associated threat of “peak food”

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.05
Raw	1	11	7	6	2	27	Mean=2.89
%	2.8	30.6	19.4	16.7	5.6	75.0	Median=3.00

As exemplified by the rice crisis in Vietnam in 2008 and the potato famine of 1840, mono-crops and their associated industry and dependent food infrastructures are very vulnerable and have worldwide impacts when they fail. There has been a 75% drop in crop diversity since 1900, and now the world population is dependent on just 20 varieties of plants for 90% of all calories, with the bulk coming from rice, corn, wheat, and potatoes. Possible mitigations include, but should not be limited to:

4.3.1 A nation-wide but locally realized initiative to provide “local grown tax-free zones” for farmers' markets. The zones would be targeted for areas currently with limited access to fresh fruit and vegetables.

4.3.2 A nation-wide but locally realized initiative to provide commuter services to provide access to the “local grown tax-free zones.” Using the surplus transportation bandwidth available on weekends, commuter services would utilize existing commuter lines to bring people to the zones and to bring produce to the zones from rural areas.

4.3.3 A nation-wide but locally realized program for the establishment of COOP packaging/canning facilities. Ideally developed in or in close proximity to “local grown tax-free zones,” the facilities would be available for contract packaging, processing, and/or canning of produce available from the “local grown tax-free zones.”

4.3.4 Restrict unnecessary consumption of grains in some industries, freeing land for food production.

### 4.4 Moving garbage to developing countries increases pollution

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.31
Raw	3	5	8	6	7	29	Mean=3.31
%	8.3	13.9	22.2	16.7	19.4	80.6	Median=3.00

Moving garbage to developing countries which have no effective regulations and technology to prevent further pollution will lead to worsening pollution situations for these countries. This will be harmful for human health and the contamination of biological systems.



## 5. Human Behavior Related

### 5.1 Population growth

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.31
Raw	9	12	6	4	4	35	Mean=2.49
%	25.0	33.3	26.7	11.1	11.1	97.2	Median=2.00

In the first decade of the 21<sup>st</sup> Century population growth has continued to accelerate from 6 billion to nearly 7, it is forecast to reach 9.7 billion by 2050. Extreme growth in the number of people being born and the earth's inability to sustain the burgeoning population – with regards to food, water, space, healthcare, and education

5.1.1 The role of education, and in particularly that of women, is critical. Where women have achieved broadly equal status with men, when there is provision for their old age, when they can use contraceptive devices, and most importantly when they are educated as full citizens, human fertility has dropped: in many industrial countries below replacement rate and elsewhere by a substantial margin.

5.1.2 At the same time people are living longer, itself creating problems.

### 5.2 Unwillingness to accept the need for change

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.28
Raw	3	4	11	5	8	31	Mean=3.35
%	8.3	11.1	30.6	13.9	22.2	86.1	Median=3.00

Most of humanity harbors an almost instinctive resistance to change, especially if it is perceived to result in a reduction in our current circumstances. We attempt to preserve the present for as long as possible. Global issues such as climate change, energy, and food security require populations en masse to accept the need for change.

5.2.1 In order to persuade people to accept the need for change one needs to demonstrate unequivocally that their current course of actions and policies will have devastating results. This can only be done by collecting overwhelming evidence which requires large-scale investment in scientific research and public information campaigns.

### 5.3 Growing world wide unemployment

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.22
Raw	4	9	7	8	3	31	Mean=2.90
%	11.1	25.0	19.4	22.2	8.3	86.1	Median=3.00

Increasing the gap between the haves and have not's will continue to destabilize many countries. The introduction of some new technologies risks increasing unemployment.

5.3.1 Some locations should emphasize small but efficient industries and farms requiring greater human labor

#### 5.4 Citizen Revolts

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.38
Raw	3	11	9	5	3	31	Mean=2.81
%	8.3	30.6	25.0	13.9	8.3	86.1	Median=3.00

Increasingly frequent and increasingly massive citizen protests in the western world.

5.4.1 Adjust government policies to promote fairness between corporations, citizens, and government.

5.4.2 Train the military and National Guard for such potential threats

#### 5.5 Tensions and instabilities in and around China

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.17
Raw	2	10	8	6	4	30	Mean=3.00
%	5.6	27.8	22.2	16.7	11.1	83.3	Median=3.00

China has developed at an unsurpassed and unbelievable speed. It is de-facto world leader in many respects. History has shown that such power developments sooner or later lead to (internal and/or external) social and political shifts. It is unclear when, where and how these shifts will take place, how the current powers will respond, and how these changes will affect the 'Western' world.

5.5.1 Diplomacy, exchange, and communication. Dialogue, democracy, and transparency, keep talking.

#### 5.6 Totalitarian ideologies

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.28
Raw	3	8	11	3	7	32	Mean=3.09
%	8.3	22.2	30.8	8.3	19.4	88.9	Median=3.00

From rogue states and terrorist movements. The modern (integrated, globalized) market economies will continue to attract envious responses from groups with a different view.

5.6.1 Intelligence, information dissemination, diplomacy, patience.

5.6.2 Support local counter valuing movements.

5.6.3 If all else fails: isolation and attack.

#### 5.7 Destructive behavioral changes

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.16
Raw	4	7	9	8	2	30	Mean=2.90
%	11.1	19.4	25.0	22.2	5.6	83.3	Median=3.00

Society continues to evolve; the recent Arab Spring and Occupy Wall Street movements, along with frequent large protest and disruptions at global financial summits, are a sign of an increasing level of friction between "haves and have not's". There is the potential that this increases and possibly leads to larger disruptive protests and civil unrest (think French Revolution).

5.7.1 Not sure that there is much for the EM Community to do about this other than monitor and update civil unrest polices.

5.7.2 Politicians and law enforcement need to think about how to handle the unruly masses with non violent and less than lethal means.

5.7.3 Perhaps being proactive and engaging the protesters in the conversation before they protest?

### 5.8 Reoccurring financial crisis or a true major recession

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.09
Raw	7	14	7	2	2	32	Mean=2.31
%	19.4	38.9	19.4	5.6	5.6	88.9	Median=2.00

Man made activities can lead to more numerous financial emergencies as a more frequent event.

5.8.1 Financial Institution audits have to emphasize the impact of external risks and potential emergencies to held loans, derivatives, and/or policies.

5.8.2 Emergency Preparedness audits for organizations of all types have to become a new auditing process for all types of organizations: private and public.

5.8.3 Reworking supply chains to include significant increases in inventory or stockpiling.

### 5.9 Increase in meat consumption

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.26
Raw	2	5	6	9	9	31	Mean=3.58
%	5.6	13.9	16.7	25.0	25.0	88.1	Median=4.00

Growth in the number of humans consuming meat, which is an unsustainable chain of events – farmers require a lot of land to raise animals, they also require water, grain/grass to feed the animals – this process causes too many resources to be spent on raising meat, as opposed to consumption of plant-based foods which is far more sustainable. Change in life style of meat consumption would free land for agricultural food supplies.

5.9.1 This is a cultural shift – many see meat consumption as a sign of wealth, many enjoy meat, it's a part of their daily lives. Programs would have to be implemented that give beef/chicken/etc. farmers incentives to shift their focus to other forms of food.

### 5.10 Overfishing in the oceans

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.32
Raw	6	9	9	3	5	32	Mean=2.75
%	16.7	25.0	25.0	8.3	13.9	88.9	Median=3.00

Fish and other sea life are being killed off at an unsustainable rate – too many are being caught and consumed without the ability to maintain or grow their populations. A growing number of fish types have already declined to limits where they are no longer viable for the fishing industry.

5.10.1 Make more areas of the ocean illegal to fish – and increase official patrols of these areas to ensure that commercial fisherman do not deplete the fish populations.

5.10.2 Strict limits on catches established by Marine Biologists and enforced by international treaties.

### 5.11 Economic crisis continues and reduces research funding

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.02
Raw	1	8	11	8	3	31	Mean=3.13
%	2.8	22.2	30.6	22.2	8.3	86.1	Median=3.00

As the economic crisis continues, the strain on public funding becomes increasingly tough, and reduces even further research funding, esp. for prevention and preparedness as these are less ‘visible’ research areas.

### 5.12 Social media get too much attention by emergency responders leading to a (geographic and other) bias in crisis response

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.00
Raw	0	5	5	14	7	31	Mean=3.74
%	0	13.9	13.9	38.9	19.4	86.1	Median=4.00

Disasters in developing countries / less ‘sexy’ disasters are not taken up by social media as much as disasters in western societies, creating a bias in attention and hence response

### 5.13 Collapse of the international financial system

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.13
Raw	8	10	8	5	1	32	Mean=2.41
%	22.2	27.8	22.2	13.9	2.8	88.9	Median=2.00

The international system collapse causing the bankruptcy of several national economies.

5.13.1 Active governmental policies on sustainable growth and market supervision, focused on empowering the SME and the low and middle class investment and saving capacity.

### 5.14 Failure of a major country to pay its debts

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.08
Raw	4	11	10	4	2	31	Mean=2.65
%	11.1	30.6	27.8	11.1	5.6	86.1	Median=3.00

If political turmoil occurs in a major economy such as Germany, UK or US and the debts of that country could not be paid this would cause a worldwide economic problem for all countries. The interconnection of economies has already meant that when tiny Iceland had a problem the world had economic problems, imagine what would happen if a major economy had the same problems as Iceland or Argentina had.

### 5.15 Growing political instability in Western democracies

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.31
Raw	2	9	7	4	7	29	Mean=3.17
%	5.6	25.0	19.4	11.1	19.4	80.6	Median=3.00

Modern democratic structures will increasingly show their inadequacy, in a globalised society and economy, especially at operational governance level.

5.15.1 Replace nation-state based democratic political structures with a model of democracy more suitable for the globalised reality of the 21<sup>st</sup> century world.

### 5.16 Serious long-term consequences of natural disasters

Votes	Extremely	Very	Important	Slightly	None	Total	SD=
Raw	5	10	10	6	1	32	Mean=2.63
%	13.9	27.8	27.8	16.7	2.8	88.9	Median=3.00

As catastrophes increase in number and magnitude, their long-term consequences will seriously affect the social, political, and economic fabric of the affected countries. As a consequence, political change (like in Japan after the recent tsunami), social change (mass migrations) and economic crisis are more likely to occur.

5.16.1 Raise awareness of the political aspects of natural disasters and environmental disasters in general.

5.16.2 Stop considering these events as exceptional happenings, as they become a systemic feature in the political system.

5.16.3 Develop the new discipline of *Emergency Politics*, coordinating reconstruction efforts at national and transnational level.

### 5.17 Increased rivalry between Nation-States and Non-Governmental Organizations (NGOs)

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.07
Raw	1	7	7	11	3	29	Mean=3.28
%	2.8	19.4	19.4	30.6	8.3	80.6	Median=3.00

In issues of domestic, international, and transnational affairs, the relationship between discredited Nation-States and operationally ineffectual NGOs will grow in difficulty, resulting in lack of coordination and increasing conflict between the parts.

5.17.1 A new model of democracy for a global world will provide an appropriate framework for the relationship between Non-Governmental Organizations and formal political authorities.

### 5.18 Increased inability of Political Science and Political Theory to make current-time prescriptions and future analysis

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.23
Raw	2	4	4	11	7	28	Mean=3.61
%	5.6	11.1	11.1	30.6	19.4	77.8	Median=4.0

Growing globalization will continue to erode the modern concept of democracy based on a nation-state polity. The need of new political categories able to generate the democratic structure of a globalised world cannot be attended by the current condition of the discipline. The lack of a political modeling approach based on classic concepts of political theory will reduce political science to a reactive analysis and feeble prescriptive work.

5.18.1 Development of a new theoretical and operational model of democracy for a global reality will provide the much-needed prescriptive frame for humanitarian intervention. This model can only be developed with a change of paradigm in Political Science and a new role for Political Theory.

### 5.19 Growing inconsistencies in the U.S. Judicial Process

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.44
Raw	3	3	3	6	7	22	Mean=3.50
%	8.3	8.3	8.3	16.7	19.4	661.1	Median=4.00

Supreme Court decisions reversing earlier decisions, for example, stating that the First Amendment only applies to laws enacted by the Congress, not necessarily by the states. Thus, states are free to end the separation of church and their state.

5.19.1 Use federal leverage such as payments to states to pressure those states that take actions deemed to undermine the traditional separation of church and state.

### 5.20 Hyperinflation

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.01
Raw	1	6	12	6	3	28	Mean=3.14
%	2.8	16.7	33.3	16.7	8.3	77.8	Median=3.00

Loss of confidence in the dollar and euro, resulting in global economic crisis with depression likely. China dumps its huge dollar reserves.

5.20.1 Declare a national emergency and use the federal power to take over temporarily control of financial institutions. Try to limit the impacts in the U.S. by suspending international financial linkages.

### 5.21 Increasing unrest owing to ineptitude, corruption, and greed

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.16
Raw	3	4	11	8	4	30	Mean=3.20
%	8.3	11.1	30.8	22.2	11.1	83.3	Median=3.00

The current financial crisis has increasingly been perceived as caused by ineptitude (politicians, financing institutions, hedge funds, ...) by the affected. The impact on society in Greece, Italy, etc is huge and discontent is growing. This will lead to more unrest and polarization of society, with victims caused by aggressive demonstrations and danger of getting out of control, including growth of radicalism. An additional complication is the increasing proportion of retired people and the diminishing fraction of younger persons with jobs.

5.21.1 The fundamental solution would be to vote for better politicians, who also would contribute to establish better frameworks for financial institutions and business matters.

5.21.2 Again, this requires more insight and better education.

5.21.3 To mitigate the unrest, nations must cooperate better.

5.21.4 As to the impact of increasing age, societies must encourage older persons who are able to work to stay active longer.

5.21.5 Also, younger people in rich societies should be encouraged to have children earlier (and have more children) through generous "family" policies (such as e.g. in Norway).

## 5.22 Breakdown of Mideast societies

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.13
Raw	3	5	9	7	2	26	Mean=3.00
%	8.3	13.9	25.0	19.4	5.6	72.2	Median=3.00

Population in Palestine, Yemen, Saudi Arabia, Egypt, etc has more than quadrupled during the last 50-60 years while the economic conditions for most citizens have not improved. There is plenty of doubt that the Arab Spring will lead to peace and stability. Rather, the stage is set for disputes and acts of violence between sectarian groups and religions.

5.22.1 This is perhaps the hardest problem of all, as every factor seems to work against a fundamental solution in the affected countries. Europe must be prepared for an unimaginable flow of people crossing the boundaries and seeking refuge.

## 6. Human Induced

### 6.1 Space rubbish falling to earth

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.11
Raw	1	4	3	13	8	29	Mean=3.79
%	2.8	11.1	8.3	36.1	22.2	80.6	Median=4.00

In the stratosphere, there are lots of space artifacts that have been launched to space since the sixties. As soon as those engines and devices lose speed and get closer to the earth, they are attracted by gravity. The collision of those artifacts with the surface is not under control, so they can hit urban areas and produce human casualties.

6.1.1 Study life cycle of artifacts orbits and create a public tracking system.

6.1.2 Develop new technologies for neutralizing artifacts falls before colliding with the surface of the earth.

6.1.3 Minimize impacts by creating a precise forecast about the trajectory and area of impact.

### 6.2 Deforestation

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.30
Raw	10	11	2	6	2	31	Mean=2.32
%	27.8	30.6	5.6	16.7	5.6	86.1	Median=2.00

A leading cause of floods, mud slides, land erosion, etc. in many parts of the world. Further release of carbon dioxide into the atmosphere.

### 6.3 Waste water injection into the earth

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.27
Raw	4	8	6	5	3	26	Mean=2.81
%	11.1	22.2	16.7	13.9	8.3	72.2	Median=3.00

A potential cause of more severe earthquakes and potential contamination of existing water sources.

#### 6.4 Hydraulic fracturing for fossil fuels

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.27
Raw	4	8	6	5	3	26	Mean=2.81
%	11.1	22.2	16.7	13.9	8.3	72.2	Median=3.00

Contamination of soil and with unknown chemicals. Forcing of gases into water systems. Lack of any national standards for protecting the environment.

#### 6.5 Creation or modification of large bodies of water

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.20
Raw	3	4	9	8	4	28	Mean=3.21
%	8.3	11.1	25.0	22.2	11.1	77.8	Median=3.00

Dams, dikes, and channeling of water flow can increase the severity of earthquakes and greatly change flood potentials.

#### 6.6 Deterioration of barrier islands and tidal lands

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.24
Raw	4	6	6	11	3	30	Mean=3.10
%	11.1	16.7	16.7	30.6	8.3	83.3	Median=3.00

Removes protection to human areas from the impact of hurricanes, cyclones, and tsunamis. Ecological destruction of original flora and fauna and the spawning areas for sea life.

#### 6.7 Invasions of exotic or foreign flora and fauna

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.10
Raw	2	6	9	10	3	30	Mean=3.20
%	5.6	16.7	25.0	27.8	8.3	83.3	Median=3.00

Severe harm possible to local ecology and in some significant damaging to man-made infrastructures (e.g. water treatment, waterways, food sources, etc.)

#### 6.8 Elimination of wide area flood plains and swamps

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.20
Raw	5	9	7	7	2	30	Mean=2.73
%	13.9	25.0	19.4	19.4	5.6	83.3	Median=3.00

Removes the ability of a land area to absorb large amounts of water and to prevent floods of co-located areas (e.g. recent Bangkok flood)

#### 6.9 Critical Infrastructure breakdowns due to ageing

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.14
Raw	10	10	10	2	2	34	Mean=2.20
%	27.8	27.8	27.8	5.6	5.6	94.4	Median=2.00

Lots of critical infrastructure is ageing and may break down causing disruptions in electricity, water, traffic, roads, bridges, sewers, gas, etc.



### 6.10 Urbanization of Western China

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.18
Raw	2	6	5	10	3	26	Mean=3.23
%	5.6	16.7	13.9	27.8	8.3	72.2	Median=3.50

The effect of urbanization of the western part of China on the environment: Urbanization of western China is an inevitable stage following the developing of eastern part of China. The consumption of local resources (especially the water) associated will inevitably affect the fragile environment in the west (desertification, soil erosion, etc.), which is almost unrecoverable. And this will then influence the weather associated and further influence the east part of China and the Asia-Pacific region.

6.10.1 The traditional extensive mode of development applied in east part of China is no longer suitable for the west part. A more detailed, specialized and well designed development mode should be investigated.

### 6.11 Electrical shortage in significant parts of China

Votes	Extremely	Very	Important	Slightly	None	Total	SD=.872
Raw	0	3	9	10	3	25	Mean=3.52
%	0	8.3	25.0	27.8	8.3	69.4	Median=4.00

The difference in the geographical distribution of production and consumption of electricity and the local protectionism of the China national electrical distribution network.

6.11.2 Create a centralized governmental based coordination mechanism for handling electricity distribution across regions and its associated price.

### 6.12 Mismanagement and scarcity of water resources

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.25
Raw	7	8	9	3	3	30	Mean=2.57
%	19.4	22.2	25.0	8.3	8.3	83.3	Median=2.50

Water shortfall in municipal and agricultural infrastructures – As witnessed by the recent protracted drought in Texas, water resource management is under the control of second order bureaucrats with little if any experience in: crisis management, long term grass roots, government proactive measures, and/or technology.

Without fresh water, there would be no life on earth. Yet demand for water already exceeds supply in many parts of the world, including parts of the U.S. In the U.S., the EPA has jurisdiction over water quality. No single Federal agency has jurisdiction over water quantity.

Possible mitigations include, but are not limited to:

6.12.1 An aggressive pursuit of “gray water” policies for municipalities. In many areas, “gray water” is not permitted for use in irrigation, toilet flushing, etc. By requiring the use of “gray water,” significant savings of water could be realized. Pragmatically, the goal would be to effect better water use by code enforcement in new construction.

6.12.2 A realistic and fair assessment of water use methods. In most areas micro-irrigation or drip irrigation are categorized with all other irrigation. This policy

penalizes those attempting to conserve water on an equal basis with those that squander water.

6.12.3 Innovation in water gathering and use. As an example, in much of the nation humidity is such that the condensation from a Median size air conditioner will produce 5 to 10 gallons per day. A simple gathering and storage system for the condensate would provide a home with a supply of water for micro-irrigation. Even a minor system could generate 35 gallons of water for irrigation each week.

6.12.4 Create a Department of Water, organized by watershed, with responsibility for both water quantity and water quality, with a strong R&D arm and a basic sustainability mission.

**6.13 Increasing severity of natural disasters owing to overpopulation:**

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.33
Raw	7	6	11	4	5	33	Mean=2.82
%	19.4	16.7	30.6	11.1	13.9	91.7	Median=3.00

Overpopulation affects conditions that modulate the impact of natural disasters. E.g., the current flood disaster in Thailand is aggravated by deforestation, growth of surfaces that do not absorb water (roads, canals, cities, etc).

6.13.1 The fundamental solution would be to reduce the number of births. This is extremely difficult and – even if successful – a noticeable impact would only come after generations.

6.13.1 Contributing to better education in countries with a high rate of births might help a bit in reducing births while increasing the preparedness against future disasters.

**6.14 Perverse consequences**

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.19
Raw	6	4	9	5	1	25	Mean=2.64
%	16.7	11.1	25.0	13.9	2.8	67.4	Median=3.00

Consequences that have not been planned for in spite of recognition of the hazard risk and provision of planned mitigation, response, and recovery (e.g. collapse of social norms, failure of insurers to payout on losses, and sale of second hand radiation contaminated vehicles from Fukushima).

## 7. Information Warfare

### 7.1 Vulnerability of cyber infrastructure

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.08
Raw	13	7	9	4	0	33	Mean=2.12
%	36.1	19.4	25.0	11.1	0	91.7	Median=2.00

The threat of infrastructure/life system disruption due to vulnerable cyber systems. Collapse of the Internet. The network ceases to function as the result of cyber attacks. We are more and more reliant on high speed communications from the WEB/Internet for both business and social communications. Local area collapses of communications links can have considerable impact. A continent wide or global collapse lasting several days would be catastrophic at many levels.

Malicious activity can disturb/interfere with operations of essential services such as security, defense, power plants, as well as banking, commerce, etc. While attention is being paid to this issue, it does not appear to be sufficient, considering the potential consequences.

Intermittent attacks on communications networks from sources hard to identify, resulting in interruptions to international banking, global corporate operations, and other functions.

7.1.1 Increased investment in secure systems to protect critical infrastructure that is reliant on the Internet

7.1.2 Assuring the reliability and redundancy of the Internet infrastructure  
Not sure of any clear mitigating actions. The Internet is resilient; that was its key design criterion. So it is hard to imagine what could take it and other forms of communication down as a single event. However, attacks by one or more countries using well trained experts are a real possibility.

7.1.3 Greater attention to improving security of such systems is needed.

Expand the role of the U.S. military cyber-warfare command to identify and immobilize the penetrators.

### 7.2 Disruption of essential information services

Votes	Extremely	Very	Important	Slightly	None	Total	SD=.946
Raw	8	14	10	1	1	34	Mean=2.21
%	22.2	38.9	27.8	2.8	2.8	94.4	Median=2.00

Massive Denial of Service attacks and serious widespread virus attacks that effectively shut down, expose, capture information, and allow massive from large installations on the internet.

7.2.1 Additional government funding for research solutions.

7.2.2 Swifter and more severe penalties for perpetrators.

7.2.3 International court jurisdiction with consistent penalties worldwide

7.3.3 International agreements for extradition of perpetrators.

### 7.3 Disruption of electrical power

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.05
Raw	14	9	7	1	1	32	Mean=1.94
%	38.9	25.0	19.4	2.8	2.8	88.9	Median=2.00

Massive power failure from cyber attack on SCADA systems

(SCADA: Trade name for process control systems that run industrial control systems)

7.3.1 Engineering of local failover (designs that will recover operations after a failure) power systems

### 7.4 Disruption of Missile defenses

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.18
Raw	3	9	8	3	3	26	Mean=2.77
%	8.3	25.0	22.2	8.3	8.3	72.2	Median=3.00

Corruption of the systems that support our missile defenses

7.4.1 Engineering of an alternative to the current missile defense capabilities

### 7.5 Stuxnet type worm attacks on real time control systems

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.22
Raw	8	9	6	3	2	28	Mean=2.36
%	22.2	25.0	16.7	8.3	5.6	77.8	Median=2.00

The recent attack of the Stuxnet worm in an Iranian nuclear power plant in 2010 on the control units for the centrifuges caused them to spin too fast. Any controller of any process (e.g. water treatment, flood gates, other infrastructure) can be attacked in a similar manner if there is a network connection. The process of such an attack has been demonstrated by using only one technically qualified person and about \$20,000 worth of equipment (DR 577—Disaster Research News, November 3, 2011, hazctr@colorado.edu)

## 8. Physical Warfare

### 8.1 Open conflict between two leading countries of the world

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.30
Raw	6	13	4	2	4	29	Mean=2.48
%	16.7	38.1	11.1	5.6	11.1	80.6	Median=2.00

A major armed conflict between two G-20 countries occurs.

8.1.1 Bridging the gap between developed and emerging economies through more robust international policy mechanisms, facilitating the transition to a new economic order.

### 8.2 The effect of pirate activities

Votes	Extremely	Very	Important	Slightly	None	Total	SD=.974
Raw	0	7	8	11	3	29	Mean=3.34
%	0	19.4	22.2	30.6	8.3	80.6	Median=3.00

The increasing frequency and geographical span of pirate activities leads to not only the lack of safety of maritime transportation, but also the commercial factors that are associated (re-scheduling of transportation routines, increased insurance expense, supply chain interruption, etc.).

8.2.1 Create an international based coordination mechanism across relevant coast countries to organize the guarding of responsible areas.

International agreements that would allow military attacks on Pirate bases in countries that allowed this type of operation.

### 8.3 Civil war in China possibly involving Japan and Taiwan

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.35
Raw	4	5	7	5	5	26	Mean=3.08
%	11.1	13.9	19.4	13.9	23.9	72.2	Median=3.00

Leading to major shortages of goods vital to the way people live in the world. The dictatorship in China is succeeding in keeping peace but if civil unrest were to occur leading to a shutdown of economic activity then many goods now only produced in China will not be available. Since they are the only provider then shortages will occur. Electronics largely come today from that area of the world and would not be available because there are no longer sufficient manufacturing facilities in the rest of the world.

#### 8.4 Countries unprepared for war or large regional catastrophes

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.11
Raw	4	6	9	9	1	29	Mean=2.90
%	11.1	16.7	25.0	25.0	2.8	80.6	Median=3.00

One of the primary purposes of a federal government is to protect the national borders of its country. The U.S. federal government has that responsibility and the planning in place, especially for the instance of a physical invasion of U.S. soil. However, if war came to the borders and shores of the U.S., it would obviously mean that a state, country, and/or city would be directly impacted immediately. Most U.S. states and local governments in the United States no longer have specific and current State of War emergency plans.

8.4.1 In order to insure the immediate needs of the public health and safety, local and state governments require a contingency plan for war that includes:

Threat Analysis

Situational Awareness Guidance with Action Trigger Points

A Concept of Operation Plans (including how to work with state and federal troops, martial law coordination, mass evacuation and relocation, continuity of government and continuity of operations, and, of course mass casualty coordination.)

8.4.2 Local and state authorities should be required to maintain these plans even though current trends indicate a time of peace.

History is clear in its provision of examples of cultures that ignored this premise of planning and thereafter fell into decline after the impacts of war.

#### 8.5 Severe oil shortages will produce warfare

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.23
Raw	5	5	10	7	3	30	Mean=2.93
%	13.9	13.9	27.8	19.4	8.3	83.3	Median=3.00

Overthrow of Saudi Arabian government by Islamic radicals.

8.5.1 Try to isolate Saudi Arabia and arm opposition groups. Stopping oil shipments from the country is not an option as non-U.S. customers will undercut such efforts. They need the oil and will go to great lengths to assure their supply line is kept open.

## 9. Public Health Related

### 9.1 Maintaining a healthy population

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.31
Raw	7	8	9	4	4	32	Mean=2.69
%	19.4	22.2	25.0	11.1	11.1	88.9	Median=3.00

The dramatic increase in diseases such as type II diabetes is fast becoming the 21<sup>st</sup> Century's major public-health concern. This condition is now nearly 4 times as common as all forms of cancer combined. By 2025, it is estimated that more than 5 million people in the UK will be living with this disease. The cost in terms of medical and social care, unemployment benefits, etc, will be overwhelming.

9.1.1 The threats are unhealthy diet and lack of exercise, which is driven by education, income, excessive work hours and profit based food manufacturing. Actions or policies that act against these include – public health education, food legislation and labeling, forcing manufacturers to produce healthier food, raising lowest incomes and introducing healthy activities within work hours.

### 9.2 Food security

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.29
Raw	12	3	11	4	2	32	Mean=2.41
%	33.3	8.3	30.6	11.1	5.6	88.9	Median=3.00

It is estimated that 70% more food is required by 2050. A complex web of difficulties must be resolved in order to even maintain food supplies at current levels: an oil-reliant food system (fertilizers, machines, transport); an environment under stress (climate change, water and soil); biodiversity loss (the plants and life on which we rely); land use competition (food vs. fuel vs. biodiversity vs. ecosystems support); growing world population and excessive consumption and waste in developed countries. Large increases in basic food stuff are threatening some economic systems. Social unrest has already been seen in countries where the cost of food represents a large proportion of income expenditure.

9.2.1. Food use in the developed world is hugely wasteful. Some 30-40% of what is bought "fit to eat" is thrown away. In developed countries, our consumption patterns panders to an "eat what you like" consumerist culture. We need to think not just about whether food is available but also the type of diet, impact of production and transportation. Simply, the future requires sustainable diets fed by sustainable food supply chains. This threat can be in part mitigated by a returning to a culture of locally produced seasonal staples together with food pricing that reflects the true environmental impact of production and transportation.

### 9.3 Pandemic Flu

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.22
Raw	8	8	7	8	1	32	Mean=2.56
%	22.2	22.2	19.4	22.2	2.8	88.9	Median=2.50

Folks don't get flu shots like they should. We have a potential for a major flu pandemic. The Mexican flu was a "false alarm" but we may face a real global outbreak causing global shutdown of travel, schools, and giving a fatal blow to an already faltering economy. History tells us that plagues (which kill millions of people) occur from time to time. When is the next one coming and how will it affect our economic and medical facilities? A breakout of any new infectious disease may originate in some remote area and defy early detection.

9.3.1 Probably nothing will happen until we actually see a pandemic flu.

9.3.2 Organizations need to gear up to allow for large scale online activities of employees when and if we have a flu actively spread by contact.

### 9.4 Radioactivity

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.27
Raw	4	6	9	7	5	31	Mean=3.10
%	11.1	16.7	25.0	19.4	13.9	86.1	Median=3.00

Many urban areas are being constructed on terrains over granite layers. It is a fact that there are hazardous amounts of radon in those areas. As any radioactive element, radon produces cancer. In a short period in some urban areas constructed over granite layers, the number of people suffering from cancer is going to increase.

9.4.1 Measure radon in constructed urban areas and generate plans to inform population and re-urbanize in case of high levels.

9.4.2 Prospect the surface of potential urban areas looking for granite layers and avoid urbanizing in those areas.

### 9.5 Lack of water treatment facilities

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.20
Raw	7	9	8	4	2	30	Mean=2.50
%	19.4	25.0	22.2	11.1	5.6	83.3	Median=2.00

A very large percentage of the world's population drinks untreated water. This leads to many deaths among the young and elderly and a potential for new types of pathogens. The actual percentage is not obvious or apparently known but could be between 30-60%. This fundamental cause of many health problems has not received the emphasis it deserves relative to other efforts at humanitarian aid for symptoms rather than causes.

9.5.1 Use of ultraviolet radiation maybe a promising low cost way to destroy waterborne pathogens if local water can be channeled through local drinking water sites and electricity is available.



## 10. Terrorism

### 10.1 Attacks on major special events

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.19
Raw	11	7	7	4	1	30	Mean=2.23
%	30.8	19.4	19.4	11.1	2.8	83.3	Median=2.00

Like the Super Bowl. A lot of things could be done to disrupt or cause illnesses or deaths. The federal government needs to make more decisions on these things.

- 10.1.1 The feds let the locals decide most of what happens in these events. 10.1.1 They should make some stronger stipulations about using neighboring public safety programs and others.

### 10.2 Pandemics, viruses' insertion

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.21
Raw	11	7	6	4	1	29	Mean=2.21
%	30.6	19.4	16.7	11.1	2.8	80.6	Median=2.00

The spreading of viruses causing a pandemic outbreak is a threat that can be developed in a natural way or man-made. New ways of terrorism could include the inserting of viruses in to the air or in distribution networks of water.

- 10.2.1 Study old, present, and future virus threats that can affect people.  
 10.2.2 Study ways of propagation and inhibiting it in urban areas.  
 10.2.3 Generate plans to protect water distribution from the introduction of undesired viruses.  
 10.2.4 Generate plans to protect food chains from natural contamination or terrorism  
 10.2.5 Modernize detection of threats for water and food production and distribution facilities.

### 10.3 Concentrations of industry targets

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.00
Raw	3	5	13	7	1	29	Mean=2.93
%	8.3	13.9	36.1	19.4	2.8	80.6	Median=3.00

There are many locations within urban/suburban areas having a concentration of industrial sites including such facilities as fuel storage, fuel processing, chemical production, and other targets attractive to terrorists.

- 10.3.1 More complete security and protection plans for such areas involving all the facilities in one master plan are needed. Companies have to contribute resources and people to such efforts.

#### 10.4 Terrorist threat to the water supply of a major city

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.29
Raw	10	7	7	5	2	31	Mean=2.42
%	27.8	19.4	19.4	13.9	5.6	86.1	Median=2.00

Terrorists dumping chemical or nuclear material in a reservoir serving a major metropolitan area could contaminate the water supply to the city as well as the piping to the metropolitan area. The lack of water to a major city would cause considerable chaos for some length of time. It may be difficult to detect this is happening for some time after the contamination has taken place. Availability of clean water is essential, yet it is not assured. Our water supplies are at risk due to possible drought, accidental spills, or deliberate contamination.

10.4.1 Greater surveillance of the water supply system is the only solution.

Increased sampling of the water supply might be desirable.

10.4.2 Backup emergency plans are necessary.

#### 10.5 Development of new technologies that can aid terrorism

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.05
Raw	7	8	9	5	0	29	Mean=2.41
%	19.4	22.2	25.0	13.9	0	80.6	Median=2.00

Laser enrichment of fossil fuel, drones, shoulder-fired rockets, etc., have beneficial uses. However, in the wrong hands they can have disastrous effects. While this type of threat has been with us throughout history, it seems that the potential consequences have been magnified. Also, the “wrong hands” now appear to include more non-nation entities, which are more difficult to deal with.

#### 10.6 Dirty Bombs are far more likely in the next decade

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.29
Raw	7	7	6	6	2	28	Mean=2.61
%	19.4	19.4	16.7	16.7	5.6	77.8	Median=2.50

The continuing spread of nuclear capabilities to countries fostering or supporting terrorist operations make it more likely, that materials to create dirty bombs will be available to some terrorist organizations. Use of bombs or the direct spreading of radioactive materials for contamination and terror are entirely possible.

## 11. Major disasters or catastrophes

### 11.1 Another volcano eruption disturbing air traffic in Europe (or elsewhere)

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.09
Raw	1	6	7	12	5	31	Mean=3.45
%	2.8	16.7	19.4	33.3	13.9	86.1	Median=4.00

The Icelandic volcano has shown we are not prepared for this type of disaster.

### 11.2 Tsunamis that cause power shutdown to industrial sites having volatile, corrosive, poisonous, or radioactive substances.

Votes	Extremely	Very	Important	Slightly	None	Total	SD=.99
Raw	3	7	13	6	1	30	Mean=2.83
%	8.3	19.4	36.1	16.7	2.8	83.3	Median=3.00

While what happened in Japan has caused a new look at power loss consequences for nuclear sites, there are the possible release of dangerous materials (e.g. chemicals, fuels, gases, etc.) from other types of industrial processes.

11.2.1 Much stricter regulations on safety of such facilities against possible natural disasters. A number of underdeveloped countries with exploitive dictatorships have suffered serious contamination because of no standards or enforcement of such.

### 11.3 More volcanic activity in the Northern Hemisphere.

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.19
Raw	2	7	8	6	4	27	Mean=3.11
%	5.6	19.4	22.2	16.7	11.1	75.0	Median=3.00

Loss of ice cover in Northern areas is supposedly leading to more volcanic activity. Repeats of the Icelandic ash cloud may become more common.

11.3.1 Need to ensure that no "just in time" system relies on air alone (e.g. pharmaceuticals and spare parts for safety critical systems).

### 11.4 A Volcano eruption of a size having world-wide effects

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.34
Raw	3	7	9	2	7	28	Mean=3.11
%	8.3	19.4	25.0	5.6	19.4	77.8	Median=3.00

Volcanic eruptions can lead to major environmental changes in all parts of the world. Major eruptions in the past have changed the weather patterns enough to cause food shortages and unusually cold weather throughout the world.

11.4.1 Adequate emergency food storage would be necessary.

11.4.2 Population migration would become a major undertaking.

### 11.5 Threat of weather/seismic event driven cross-border mass migration

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.19
Raw	3	13	5	5	3	29	Mean=2.72
%	8.3	36.1	13.9	13.9	8.3	80.6	Median=2.00

The United States has limited ability to enforce control of the Mexican border, Australia has limited ability to protect or enforce control over the sparsely populated northern shore, and much of Europe has little or no means to enforce border control in the East. Any protracted weather/seismic driven event could trigger a mass migration on an unprecedented scale with implications for national and international relations. Possible mitigations include, but should not be limited to:

11.5.1 Identification of immediate use shelters in close proximity to the border, but outside dense metropolitan areas. The goal would be to have potential shelters available in areas that will not already be taxed by the weather event. In the case of the lower Rio Grande Valley, this will mean areas to the north and west of the valley.

11.5.2 Identification of cross border specific mass transportation to move people without vehicles to shelters. This would involve the mobilization of public transportation units (city buses, school buses, etc.).

11.5.3 Development and codification of methods for controlling cross border evacuees using their private vehicles. This would include a means to identify the vehicles, provide directions or “guide vehicles” for convoys, etc.

### 11.6 Flooding due to tsunamis or climate change

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.02
Raw	5	8	13	4	1	31	Mean=2.61
%	13.9	22.2	36.1	11.1	2.8	86.1	Median=3.00

Worldwide increase in the number of large-scale floods.

11.6.1 Monitoring and identification of underwater volcanoes and lines of weakness. (We seem to be making good progress on early warning systems for surface lines of weakness, but less progress when they are underwater).

11.6.2 More concerted effort on the effects of climate change.

### 11.7 Mega disasters

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.31
Raw	8	7	8	5	3	31	Mean=2.61
%	22.2	19.4	22.2	13.9	8.3	86.1	Median=3.00

Catastrophes with environmental impacts that overwhelm local, national, and international mitigation, response and recovery mechanisms; recent near examples include Hurricane Katrina, Mexico Gulf oil wells (Ixtoc 1979, Deepwater Horizon 2010), Sendai earthquake and tsunami Japan, Canterbury earthquake sequence NZ, flooding Thailand; possible events include major sustained volcanic eruptions (Taupo, NZ); nuclear war; Large Bolide (Impactor; Meteor) leading to mass extinctions.

## Limitations of this Effort

One of the participants who did not feel s/he could vote on the eighty six items that resulted from the first round did an excellent job of listing the limitations of the task as presented. I tend to agree with all the remarks and present those remarks below as a summary of the limitations.

On the other hand, the gathering of 86 events certainly attracted a number of events that have not been made explicit, or have not attracted serious concern, or action. The specification of the top rated events by a consensus of the extremely or very important rating is significant as well as the disclosure of the events that deserve more consideration because of uncertainties or possible disagreements is an important first step in this sort of planning process. This was really the first phase of a complete Delphi process which is the exploratory phase to obtain a more complete scope of a key list of items of a given type (Linstone and Turoff, 1975, 2010; Turoff, 2009). In this case, a list of threats were generated that should receive more attention than has been the case to date. What processes should follow this exercise will be in the conclusion section.

Here is the summary of the limitations by one of the respondents:

"Hi Murray, I hope you do not think I have reneged on my offer to contribute to the Delphi, but after having spent a considerable amount of time reading through and thinking about the list of potential threats, I think that I am not qualified to opine on the importance of each. The main reason that I don't feel comfortable voting is that the scope of the issues, I felt, is beyond my expertise in many of the cases. However, after having gone through the process of examining the list and considering each of the items, I wanted to share some of my thoughts with you in case any of them is useful feedback for you as you continue with this project.

My main feeling in trying to rate each of the threats is that in order to pass judgment on any one item the respondent has to:

- a) Be familiar with the potential of the event (the premise of some of the items seemed debatable),
- b) Make an assessment of the likeliness of the event occurring,
- c) Know what can be done to mitigate the effects of the events,
- d) Be familiar with whether or not mitigating actions are feasible.

I realize that all of these aspects are intertwined by design to identify the threats that are most relevant to the EM community. At the same time, I felt that their inclusion in one rating was confusing for me to think about. For example, an event might have important consequences but its likeliness is ill-defined. Or it might be likely but I'm not familiar with what can be done to mitigate. Furthermore, the more I learn about the mitigating possibilities, the more relevant the item becomes - and in some cases that is influenced by the description in your document unless extensive research has been done in the area. I don't know how it fits in with the goal of the Delphi, but I

wondered if you might not get a more useful analysis of the issues by asking separate questions about the likeliness, impacts, and mitigation possibilities.

Another thing that I noticed about the items on the list is that they differ in scope. In some cases, we refer to an event without being specific about the implications of that event and in some cases; we refer to a specific impact of any number of events. Fundamentally, I think that there is a series of cascading impacts from any one event and the ones that are going to be the easiest to think about mitigating are the ones that are the most concrete. For example, any number of natural or man-made disasters can cause damage to the electric grid. But vulnerabilities in the electric grid are a very specific problem that we can think about mitigating. On the other hand, an earthquake, tsunami, or physical warfare, causes a whole spectrum of problems, so thinking about how to "mitigate the effects of an earthquake" involves much too large a range of issues to respond to. A good indicator of this is the overlap between the different categories. For example, global warming is one category and reappears as background in some other categories. Same with overpopulation. Many of the items listed as separate events are actually intertwined and often dependent upon each other.

Perhaps this difference is also, why I noticed that "mitigating the event" could mean two different things:

- a) Getting early warnings so that we can then mitigate the impact (ex. detect an oncoming earthquake so that we can evacuate), or
- b) Actually, mitigate the occurrence of the event from happening (ex. maintaining weather sensitive infrastructure so that they don't fall apart in extreme weather).

In some cases, it is hard to tell if we are talking about mitigating the event or the consequences of the event. For example, "extreme climate events" are not important in the sense that we cannot easily control them. However, there are many things that we might want to do to predict the events and protect ourselves from consequences of those events such as high winds, heavy snowfall etc. So in that sense it is important.

A number of the events on the list also rely on major events of the recent past. I was torn by these, because on the one hand we would be remiss not to learn lessons from past events. At the same time, what is the relationship between something having happened in the past and its likeliness of happening in the future? I'm not sure if past occurrences alone are evidence of a threat as much they are with the support of scientific investigation of the risk factors."

I also found myself thinking about comparing the importance of local/regional and global threats. Is a threat automatically more important if it has worldwide impact? How much of a role does the severity of the event play as opposed to its reach?

On a side note, I wanted to point out that some of the entries are political in nature. I know that you collated the contributors' responses but please be aware that, for example, mention of "Palestine" in the discussion of the middle east reflects a highly controversial viewpoint that is not held by the UN and most Western countries.

I apologize that I was not able to contribute to your project in the way that you had asked but I hope that these observations (as raw as they are) are somewhat useful to you. I certainly appreciate the opportunity to be involved in this process as I found the activity very interesting and thought-provoking and can imagine myself referring back to this and the ultimate results in the future. In particular, I'd love to see how some of my questions/thought resolves themselves in the following rounds and resulting discussions. I'd appreciate if you could keep me included on further stages of your work.  
Thanks again."

Emergency planning and preparedness, especially the area of planning based upon better understandings of the relevant threats, the mitigation efforts that should be implemented, and the resources, policies, and trained professionals that will be needed should be a continuous process that is updated as new information and findings become available (Turoff, et al, 2009, 2011, Turoff, 2012). Such plans should be a community based process involving all those who should be involved (Hiltz and Turoff, 1978, 1993, Turoff and Hiltz, 2008, 2009). In an urban, suburban, or rural community, this should involve the public. Only when they understand, contribute, and support the planning process are local politicians and decision makers likely to support meaningful mitigation and investment actions.

For regional, national, and international disasters, all of the relevant organizations, public, private, non-profit, and humanitarian need to be involved in the planning process (Van de Walle, Hiltz, and Turoff, 2010). What is missing for organizations, of any type, today is a requirement to do a public Emergency Prepared Audit for the threats they likely face (Turoff, et al, 2004, Baksa & Turoff, 2011). The only area of planning that deserves some secrecy is that having to do with the detection of and security from potential terrorist actions and their apprehension. Many of the resources and response activities for the damages resulting from terrorist activities are very similar to what is need for many other disaster responses.

## Conclusion and Future Efforts

When we started to examine the results, we were hoping we would find some differences in the voting patterns by professional backgrounds. We did not have large enough of a sample to examine very finite differences like "government employee." However, we did have enough for looking at the three categories of: academic, practitioner, and other related fields. Typical numbers for 33 votes were 14, 10, and 9. We used Tukey's test in conjunction with an ANOVA. Much to our surprise, we only found one threat item out of the 86 that showed a statistically significant difference ( $F=5.533$ ,  $df = 28$ ,  $p=.010$ ). This was:

### 10.5 Development of new technologies that can aid terrorism

Votes	Extremely	Very	Important	Slightly	None	Total	SD=1.05
Raw	7	8	9	5	0	29	Mean=2.41
%	19.4	22.2	25.0	13.9	0	80.6	Median=2.00

Laser enrichment of fossil fuel, drones, shoulder-fired rockets, etc., have beneficial uses. However, in the wrong hands they can have disastrous effects. While this type of threat has been with us throughout history, it seems that the potential consequences have been magnified. Also, the "wrong hands" now appear to include more non-nation entities, which are more difficult to deal with.

The result was that the practitioners gave a higher importance rating to this item than either academics or those from other disciplines. Practitioners might have been more aware of how easily terrorists can obtain materials and technologies in the international marketplace.

One suspects that if we are able to open the 11 different categories to 11 different online discussion and voting systems we should be able to involve hundreds of professionals in each category relevant to their interests and locations. Furthermore, in many geographic areas subject to specific types of disasters, there will be many citizens interested in what sort of plans and mitigation efforts are being undertaken or should be undertaken in their location. Until the citizens in a given area can participate in the planning processes, it will remain unlikely that many important mitigation efforts will be undertaken. It takes a local culture of preparedness to encourage the leadership to invest funds. There is certainly reason to keep plans for detection of terrorists secret; however, there is not any real reason why plans for responding to the consequences of preventing disasters should be secret from the communities that might be affected.

While social networks would be the logical place to put such efforts currently they do not provide the software for specific Delphi type discussions and associated voting. Nor do they allow participants a choice of pen names, anonymity, or real names for specific aspects of the discussion. There is a real need for new types of software to support "Communities of Practice" involving both professionals and concerned citizens and communities (Turoff and Hiltz, 2008, 2009).



A through follow on effort would require 13 discussion spaces devote to:

1. Eleven discussion spaces for each category of threats that would begin to develop
2. A general discussion space on the list of Threat topics for refinement of definitions, and the continuous voting on two dimensions for each one
3. A discussion space for the collaborative rating the value of various detailed articles or reports on various disaster types
4. An ability to do voting on at least root items in any discussion space
5. An ability to establish roles or privileges in each conference for Viewers (read only), Contributors (create items), Facilitator/editor (to remove items or set roles); Voters (to vote on items).
6. Tracking of who has been voting to allow changes in votes
7. The ability of a creator of a comment in a discussion to enter it with anonymity, pen name, or with a real signature.

The lack of some of these features can still be handled if a facilitator has the time to do a monthly survey, using appropriate software, and entering the results in terms of anonymous items and voting results into the conference.

Initially, this might be limited to participants who qualify as professionals and/or academics in Emergency Preparedness and Management and related professions much as was done in this exercise. At some point, we would like to see some of this extended to open participation or similar efforts in local communities devote to those threats that are most prevalent in the local area. There are additional software considerations needed if the system went to large scale long term use. For example, installing the decay of old votes and only tracking how often an individual votes and setting time dependent limits on voting to simplify the large scale voting process.

Plans should be public to the community that is impacted by them. The lack of community involvement in planning and endorsing plans and mitigation investments is at the core of the problems we have in the effectiveness of this area.

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## Related Disaster References

- These are some recent quality reports summarizing specific disaster types. These provide more insightful details on various disaster types. Please notify us if you have any suggested additions to this list: [murray.turoff@gmail.com](mailto:murray.turoff@gmail.com) and [linda.plotnick@gmail.com](mailto:linda.plotnick@gmail.com)
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