



Disaster risk reduction in the emirate of Abu Dhabi, United Arab Emirates : effects of natural and non-natural disasters over business continuity and sustainability

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**Thèse de doctorat
de l'Université Sorbonne Paris Cité
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**DISASTER RISK REDUCTION IN THE EMIRATE OF ABU
DHABI, UNITED ARAB EMIRATES
EFFECTS OF NATURAL AND NON-NATURAL DISASTERS
OVER BUSINESS CONTINUITY AND SUSTAINABILITY**

Par Ahmed AL MARZOOQI

Thèse de Doctorat de Géographie du Développement

Dirigée par Philippe Cadène, Professeur à l'Université Paris Diderot

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Résumé

Les catastrophes ont toujours résulté d'une interaction humaine avec la nature, la technologie et les autres entités vivantes. Parfois imprévisibles et soudaines, parfois lentes et persistantes, divers types de catastrophes affectent continuellement notre mode de vie quotidienne. Les êtres humains, créatures innovantes, ont toujours cherché de nouvelles façons de freiner les effets dévastateurs des catastrophes. Cependant, pendant des années, la conduite humaine concernant les catastrophes a été de nature réactive. Les communautés, parfois conscientes des risques qu'elles rencontrent, attendaient les événements désastreux, puis activaient les plans et les procédures. Or, le développement social et économique a contribué à créer une vulnérabilité et à affaiblir la capacité des humains à faire face aux catastrophes et à leurs effets.

Ainsi, les catastrophes entravent le développement des sociétés. Le développement est lié au niveau d'exposition au risque de catastrophe dans une communauté donnée. Mais aussi, le niveau de risque de catastrophe qui prévaut dans une communauté est lié aux choix de développement effectués par cette communauté. Le lien entre les catastrophes et le développement est bien étudié et documenté. Le fait que les catastrophes ont un impact sur le développement (par exemple, une école enlevée dans une inondation) et que le développement lui-même augmente ou diminue le risque de catastrophe (par exemple, l'introduction de techniques de construction résistant aux séismes) est largement acceptée.

Les catastrophes ne sont pas nouvelles pour l'humanité. Les premiers êtres humains ont vécu, péri et survécu à de nombreuses catastrophes, incendies de forêt, tsunamis, déluge, inondation, glissements de terrain, etc. Dans le monde contemporain, l'industrialisation a entraîné de nombreuses catastrophes, comme les incendies, les explosions, les émissions de gaz toxiques, sans parler des phénomènes observables sur le long terme, effet de serre ou El Nino. Aujourd'hui, l'humanité est confrontée au défi des catastrophes naturelles et industrielles.

Depuis les dernières décennies, les catastrophes apparaissent plus complexes à cause de l'imprévisibilité des catastrophes naturelles dans un environnement très dense et de la fréquence des catastrophes causées par l'homme. Il apparaît que les pays industrialisés, Émirats Arabes Unis inclus, ont tendance à faire davantage face à des catastrophes anthropiques.

En premier lieu, cette recherche vise à évaluer les conséquences des catastrophes naturelles et anthropiques de 2005 à 2015 aux Emirats Arabes Unis, tout particulièrement dans l'émirat d'Abu Dhabi. Aux EAU, diverses organisations gouvernementales et non gouvernementales ont le mandat de superviser les activités publiques et privées susceptibles de provoquer des déséquilibres dans l'environnement conduisant à des diverses catastrophes. Il s'agit aussi d'étudier comment la gestion des risques de catastrophe (GRC) peut être améliorée aux Émirats arabes unis. A l'échelle des entreprises, une politique de gestion des catastrophes doit inclure l'information sur les des types de risques, la mise en oeuvre de stratégies de réduction des risques, puis, toute catastrophe intervenue, une communication appropriée et la reconstruction des dommages. Cela implique que l'entreprise ait un comité de planification efficace et, pour faire face à tout désastre sans délais excessifs, un groupe capable d'agir dirigé par des responsables compétents capables de prendre des initiatives.

En second lieu, la recherche vise aussi à analyser comment les processus de réduction des risques (GRC) ont été construits dans l'émirat d'Abou Dhabi par les différents acteurs concernés. Il s'agit de comprendre la situation d'aujourd'hui, comment elle peut évoluer vers une meilleure capacité de prévention et de réaction aux risques, et quels sont les acteurs publics comme privés impliqués.

Afin de répondre à ces questions, la recherche analysera d'abord les structures, les responsabilités et les procédures du gouvernement d'Abou Dabi pour gérer les catastrophes et réduire leurs risques associés. Il évaluera ensuite la sensibilisation et la vulnérabilité des populations d'Abou Dhabi à différents types de risques naturels et non naturels. Il déterminera enfin la perception des catastrophes dans la communauté des entreprises d'Abou Dabi et articulera les moyens de maintenir la continuité en

collaboration avec le soutien du gouvernement à la suite de catastrophes naturelles et non naturelles.

Les hypothèses retenues pour la réalisation de la recherche sont les suivantes :

- Au cours des décennies choisies pour cette étude, correspondant à la période de développement du nouvel Etat, l'émirat d'Abou Dhabi et l'ensemble des EAU ont fait face à de plus en plus de risques géologiques, de catastrophes climatiques et environnementales, biologiques.
- Chacun de ces événements a eu des coûts économiques et financiers élevés et ont entraîné d'importantes perturbations. La gestion des catastrophes est devenue une préoccupation publique et institutionnelle croissante, en particulier parce que souvent le risque aurait pu être mieux pris en compte. Le gouvernement des EAU et les ONG sont très actifs, en permettant d'éviter notamment les catastrophes non naturelles. Cependant, la distinction entre catastrophes naturelles et non naturelles se rétrécit à chaque décennie.

La méthodologie adoptée pour la recherche est l'approche exploratoire. Les données historiques disponibles dans les publications papier et internet sur les catastrophes naturelles et non naturelles ont été utilisées. Les données principales de la recherche ont été obtenues grâce à des entretiens, à l'administration d'un questionnaire d'enquête. Des questionnaires d'auto-évaluation, un questionnaire d'enquête, une liste de contrôle de l'analyse de référence HFA, etc. ont été développés spécifiquement pour la recherche. L'analyse de ces données utilisant des méthodes telles que "Analyse de contenu", "Analyse SWOT", "Analyse d'écart" et "Analyse d'évaluation des risques" a été effectuée pour arriver aux conclusions.

La thèse est organisée en quatre parties :

- La première partie présente les informations historiques sur les catastrophes naturelles et non naturelles tout en définissant la catastrophe dans les différentes perspectives, à savoir, technologique, politique, économique, culturelle et religieuse. Une définition des types de catastrophes et une présentation des tendances mondiales sont également présentées dans cette partie de la thèse.

- La deuxième partie expose les caractéristiques politiques, géographiques, administratives de l'Emirat d'Abu Dhabi, et tout particulièrement "l'Abu Dhabi Economic Vision 2030" et ses objectifs. Sont également présentées la géographie et la vulnérabilité aux catastrophes aux EAU et à Abou Dhabi. Cette partie présente enfin la société et la culture aux EAU, dans le but de mieux comprendre la vulnérabilité aux catastrophes et elle offre un compte rendu détaillé des catastrophes naturelles dans le Golfe et les Émirats arabes unis ainsi que les enseignements tirés des 16 catastrophes ayant eu lieu, ainsi que les mesures prises pour atténuer leurs effets. Elle donne aussi un compte rendu détaillé des catastrophes non naturelles dans le Golfe et dans les Émirats arabes unis et analyse pourquoi les catastrophes non naturelles deviennent un problème de plus en plus important dans cette région du monde.

La troisième partie est consacrée à la présentation et à la mise en discussion des rôles et des responsabilités des institutions de gestion des catastrophes à Abou Dhabi. Il énumère les organisations internationales concernées par les dangers non naturels et anthropiques et identifie les agences internationales d'atténuation des catastrophes au travail à Abou Dhabi, puis discute des rôles, des responsabilités et des instruments juridiques qui les régissent. Elle identifie spécifiquement les acteurs d'Abou Dhabi impliqués dans la gouvernance de la gestion des catastrophes. En outre, cette partie offre des éléments de comparaison avec d'autres systèmes d'administration et de gestion des catastrophes dans le Golfe et en particulier dans les EAU.

La quatrième partie présente les expériences de gestion des catastrophes à Abou Dhabi, l'analyse des informations recueillies à la suite des entretiens et des enquêtes et la discussion des résultats. Cette partie présente et discute ainsi les conclusions des différents résultats de l'analyse. Les données principales de la recherche ont été obtenues grâce à des entretiens, un questionnaire d'enquête, une liste de contrôle, etc. Des questionnaires d'auto-évaluation, un questionnaire d'enquête, une liste de contrôle de l'analyse de référence HFA, etc. ont également été conçus. Ces données ont été analysées en utilisant des méthodes telles que "Analyse de contenu", "Analyse SWOT",

"Analyse d'écart" et "Analyse d'évaluation des risques" et les résultats sont présentés dans les derniers chapitres.

La recherche effectuée montre que les Émirats arabes unis ont fait face à de nombreuses catastrophes naturelles et non naturelles dans les deux dernières décennies, ce qui a justifié la réalisation de cette étude pour évaluer la préparation nationale et régionale pour les éventualités futures. Parmi les catastrophes naturelles qui se sont produites, les EAU ont connu des mouvements sismiques et des fortes perturbations climatiques. Les Émirats arabes unis se sont révélés très vulnérables à l'impact de ces événements. Bien que les données sur les catastrophes des EAU soient rares ou limitées, nous avons pu corroborer diverses sources qualitatives avec les résultats quantitatifs pour arriver à des conclusions fiables sur les catastrophes naturelles.

Il apparaît que les catastrophes tectoniques et météorologiques sont très fréquentes dans les EAU en raison de la situation géographique du pays. Les mouvements tectoniques, autres que naturels, sont également déclenchés par les activités de forage pétrolier et de construction d'infrastructures. Une partie importante des EAU est un désert et ce facteur rend également la région extrêmement vulnérable aux tempêtes de sable et aux inondations. Au cours de la dernière décennie, il y a eu au moins 25 activités sismiques enregistrées par les autorités. Certaines des zones les plus vulnérables sont le détroit de Zagros, Masafi et Hormouz.

Les risques non naturels qui pèsent sur Abu Dhabi sont ceux liés au terrorisme, menace très importante du fait des problèmes géopolitiques de la région. Abou Dhabi dispose d'installations et d'infrastructures clés qui doivent d'être défendues contre les attaques terroristes, mais aussi contre tout incendie ou explosion. Le problème des accidents de la route est également particulièrement préoccupant à Abou Dhabi et aux EAU en général. Dans des domaines, il est important que les différents organismes de gestion des catastrophes et le public collaborent pour minimiser les impacts négatifs. Le processus de gestion des catastrophes à Abou Dhabi et aux Émirats arabes unis nécessite une préparation opérationnelle et législative afin d'améliorer l'efficacité mais

aussi d'accroître la confiance du public. En outre, de telles mesures permettront de préserver la continuité des processus opérationnels, ce qui est une préoccupation majeure pour les populations d'Abou Dhabi et des EAU. En prenant l'exemple des processus mis en place à la centrale nucléaire de Barakah, il est impératif que le gouvernement des Émirats arabes unis et les agences de gestion des catastrophes soient préparés en cas de problème. Nous constatons que le ministère de l'Énergie joue un rôle essentiel dans le soutien au redressement des entreprises et aux compensations, après les catastrophes.

Nous constatons en général que les Émirats arabes unis ont des expériences variées de catastrophes naturelles et non naturelles. Simultanément, diverses activités menées aux Émirats arabes unis ont entraîné une dégradation de l'environnement, des développements infrastructurels et une concurrence pour les ressources limitées. En outre, les caractéristiques démographiques changeantes et l'ouverture de nouveaux systèmes de règlement garantissent une gestion des risques nouvelle et continue. Nous trouvons que, en raison des différentes catastrophes naturelles et non naturelles, il existe des risques primaires et secondaires qui affectent la population des EAU. Ceux-ci ne se limitent pas aux déplacements internes de masse, aux interruptions de transport et de communication, à la propagation de maladies, à la faible qualité de vie et à la productivité, à la pénurie alimentaire, aux conflits sociaux et aux troubles. Ces risques deviennent compliqués avec le temps.

Les différents types de catastrophes affectent la population des Émirats arabes unis impliquent que le gouvernement et les nombreuses institutions soient à même de faire face aux situations d'urgence. Certaines catastrophes naturelles et non naturelles ont des effets immédiats tandis que d'autres ont des effets à moyen et à long terme. Certaines d'entre elles entraînent des déplacements permanents de personnes, ainsi d'ailleurs de leur bétail, tandis que d'autres exigent une réinstallation après évaluation des risques par les autorités concernées. Certains sites de catastrophe dans les Émirats arabes unis restent dangereux pour l'habitation ou pour les entreprises, tandis que d'autres sont réhabilités et améliorés pour éviter les événements récurrents.

L'une des principales faiblesses des EAU et d'Abou Dhabi dans la gestion des risques de catastrophe est l'incapacité de s'attaquer à certains effets secondaires des catastrophes naturelles et non naturelles. Ce travail a montré qu'il y a des cas où les organismes d'urgence désignés sont inadaptés à la gestion des événements sismiques, de la pollution, de la protection des espèces menacées, de la répartition de l'eau. Les autres faiblesses des Émirats arabes unis et d'Abu Dhabi sont l'incapacité à atténuer suffisamment les effets du réchauffement planétaire, à prévoir les cyclones et à communiquer sur leurs impacts, à construire des digues et des murs près des barrages afin de prévenir les inondations et à mettre un arrêt à une mauvaise utilisation des terres conduisant à une désertification rapide.

En raison de ces faiblesses, les Émirats arabes unis et Abou Dhabi sont sensibles à d'autres types de risques. Il s'agit notamment de l'épuisement rapide des ressources alimentaires et hydriques dans les régions urbaines et rurales, des difficultés liées à une très forte immigration internationale qui causent par exemple de sérieux problèmes de transport et de communication car les infrastructures sont insuffisantes, à des systèmes de réglementations inadéquats qui peuvent exposer les résidents à des risques futurs, comme c'est le cas dans des zones sensibles aux glissements de terrain. Enfin, les équipements sociaux sont soit surpeuplés, soit surchargés dans les EAU et à Abou Dhabi. Ceci inclut des établissements médicaux qui seraient incapables de répondre à une épidémie affectant de nombreuses personnes dans les zones densément peuplées du pays.

Le gouvernement des EAU a pris conscience de ces difficultés et s'est engagé dans une réflexion sur la gestion des risques. Il a été présent au 1er Sommet arabe sur le développement socioéconomique pour normaliser les activités visant à réduire les risques. Au cours de cette réunion, la stratégie arabe pour la réduction des risques de catastrophe (ASDRR) a été dévoilée, comprenant des actions à deux niveaux :

- Décrire une vision, des priorités stratégiques et des domaines essentiels de mise en œuvre pour la réduction des risques de catastrophe dans la région arabe

- Améliorer les mécanismes institutionnels et de coordination et suivre les modalités d'appui à la mise en œuvre de la Stratégie aux niveaux régional, national et local par la préparation d'un Programme d'action ".

Lorsque les Émirats arabes unis répondront aux décisions de l'ASDRR, des mesures supplémentaires seront apportées aux stratégies nationales et aux lignes directrices pour la gestion des risques de catastrophe. Au niveau national, il existe des agences spécifiques telles que la Défense civile, le service des incendies, divers ministères et organisations non gouvernementales. En outre, il existe des agences internationales qui travaillent le long des EAU en cas de catastrophe, notamment l'Organisation mondiale de la santé, la société du Croissant-Rouge et la Fédération internationale pour la Croix-Rouge, et les organisations météorologiques par satellite. Les Émirats arabes unis travaillent avec Hyogo Framework for Action (HFA) car il dispose d'une stratégie très robuste pour la réduction des risques et s'efforce spécifiquement pour :

- Renforcer l'engagement pour une réduction complète des risques de catastrophe dans tous les secteurs.
- Développer des capacités pour identifier, évaluer et surveiller les risques de catastrophe.
- Développer la résilience grâce à la connaissance, le plaidoyer, la recherche et les formations.
- Améliorer la responsabilité de la gestion des risques de catastrophe aux niveaux national et local.
- Intégrer la réduction des risques de catastrophe dans les interventions d'urgence, la préparation et la récupération ".

Les Émirats arabes unis ont un système continu d'évaluation des risques et des problèmes à mettre en œuvre en utilisant les équipes multi-agences. Alors que certains risques prévisibles ont un calendrier de mise en œuvre de la gestion, d'autres nécessitent une mobilisation de personnel et de ressources à l'avance pour faciliter les taux de réponse dès que les alarmes sont augmentées. Les Émirats Arabes Unis s'harmonisent actuellement avec le HFA jusqu'à 2015 et ont la possibilité d'examiner les

objectifs au-delà de cette période. Selon les obligations de la HFA, nous constatons que les Émirats arabes unis ont segmenté leurs tâches dans le cadre de l'ASDRR dans le but de minimiser la destruction des biens ou des biens, la perte de vies, le ralentissement de la croissance économique et la dégradation de l'environnement et la perturbation de la vie sociale. Les Émirats arabes unis bénéficient encore de la Ligue des États arabes pour mettre en œuvre ces programmes de réduction des risques.

Certains acteurs sont directement impliqués dans la gestion des catastrophes, d'autres travaillent en arrière-plan pour coordonner les activités et assurer des liens pour le secours des personnes ou des zones touchées. L'innovation organisationnelle et la résilience définissent la capacité d'Abu Dhabi et des Émirats arabes unis à se mobiliser et à répondre à toutes les catastrophes.

Il existe divers acteurs dont le rôle est particulièrement critique dans le processus de gestion des catastrophes d'Abou Dabi. Parmi ceux-ci se trouve la Ligue des États arabes, dont le rôle est d'offrir le leadership, le soutien, les ressources, le personnel et l'expertise pour évaluer les situations. De plus, la Ligue des États arabes s'engage à mobiliser d'autres acteurs internationaux pour aider les ressources humanitaires.

Abou Dhabi possède des centres régionaux pour la gestion des catastrophes et la réduction des risques. Ces centres sont utiles pour le renforcement des capacités et la diffusion des connaissances parmi la population sur les risques éventuels de catastrophe et les moyens de les surmonter. En outre, les Émirats arabes unis ont des autorités nationales impliquées dans les opérations réelles de gestion des catastrophes. Ces autorités ont un mandat national et sont tenues de fournir des rapports périodiques sur l'état de préparation aux catastrophes des pays. En outre, les autorités s'efforcent de travailler avec les communautés et les entreprises pour créer un environnement sûr, y compris le soutien du cadre législatif, des politiques, des règles et des règlements.

Abou Dhabi a diverses organisations de la société civile, qui sont directement impliquées dans la gestion des catastrophes et la réduction des risques. Il s'agit notamment de l'Association internationale de la Croix-Rouge, du Croissant-Rouge et d'autres organisations communautaires à but non lucratif. Ces organisations sont

intégrées dans le cadre de l'ASDRR sous la supervision du gouvernement aux niveaux régional, national et local. Ces organisations sont chargées de coordonner les efforts de sauvetage et de rétablissement des catastrophes, y compris la fourniture de matériel de secours et d'autres assistances pertinentes

Abou Dhabi est impliqué dans de nombreuses organisations internationales lors de la gestion des catastrophes et du processus de réduction des risques. Ces partenaires se complètent mutuellement pour atténuer le stress causé par les catastrophes et l'impact sur les risques pour la population et ses biens. Certains de ces partenaires sont spécialisés dans les domaines de la gestion des catastrophes et de la réduction des risques, par exemple dans les secteurs des transports, du logement, de la santé, de l'eau et de l'industrie, entre autres. Dans l'ensemble, les partenaires internationaux sont spécialisés dans les domaines suivants : «renforcement des capacités, formations, gestion du savoir, évaluation des risques, intégration de la réduction des risques de catastrophe dans l'environnement, secteurs de la santé et de l'éducation, soutien de la coordination et de l'harmonisation des outils de réduction des risques de catastrophe au niveau national Et les niveaux locaux, entre autres ».

Les acteurs moins essentiels dans la gouvernance des catastrophes comprennent les groupes et les équipes communautaires dont les intentions sont des moyens de réduire les risques à la maison ou autour de leur société. Il s'agit notamment des groupes de femmes, de jeunes et d'hommes qui ont un programme économique ou social, mais comprennent la réduction des catastrophes et la gestion comme préoccupation clé. Le rôle des acteurs non essentiels est important dans la sensibilisation aux risques liés à l'herbe, de sorte que les coûts liés à la gestion des catastrophes peuvent réduire considérablement. Environ 10% des fonds de secours appuient ces acteurs non essentiels dans la gestion des catastrophes, en particulier pour les événements postérieurs à la catastrophe. En outre, les acteurs non critiques sont utiles pour faire respecter des services de qualité lors de la gestion des catastrophes car ils fournissent des commentaires sur les lacunes ou les mesures qui doivent être améliorées à l'avenir.

Les Émirats arabes unis doivent élargir le partenariat des organismes chargés de la réduction des risques en commençant par le cadre de la politique nationale, l'examen des stratégies existantes et le soutien juridique afin que toutes les lacunes soient éliminées à l'avenir. Les politiques actuelles de réduction des risques exigent une réflexion approfondie dans des domaines tels que la réduction de la pauvreté et de la gestion de la diversité multinationale liée à la forte présence des migrants internationaux dans les zones urbaines. En outre, les politiques existantes nécessitent des campagnes de sensibilisation proactives et des informations régulières auprès du public afin de savoir ce qu'il faut faire chaque fois que différents types de catastrophes se produisent dans les Émirats arabes unis. La nouvelle politique doit aborder les problèmes de vulnérabilité différencié en fonction des personnes, avec un intérêt particulier pour les enfants et les femmes, et réfléchir à la priorité à donner en conséquence. Bien qu'il existe des organismes d'urgence spécialisés activés chaque fois qu'il y a une maladie ou des problèmes de santé publique, il faut innover afin de mieux communiquer avec les populations, réagir rapidement en cas de problème et envoyer des mises à jour régulières. Avec la pénétration des téléphones mobiles, il serait possible de compléter le rôle des radios et des autres modes de communication de masse pour signaler et réagir en cas de catastrophe. Plus généralement, les dirigeants des Emirats Arabes Unis et d'Abou Dhabi doivent innover sur la communication en matière de changements climatiques et de ses impacts sur public, afin que leurs appels récurrents pour une meilleure conservation de l'environnement. Des ressources supplémentaires doivent être affectées pour l'utilisation de satellites afin de surveiller le changement climatique et de pouvoir informer tous les partenaires environnementaux puissent des priorités en matière de gestion et de réduction des risques. En outre, les Émirats arabes unis doivent trouver les moyens de décentraliser l'information en incluant la population et de faire connaître les organismes responsables de la gestion des risques et de leurs agendas. À l'heure actuelle, les Émirats arabes unis et le gouvernement d'Abou Dhabi reposent, en matière de gestion des risques, sur des flux de données minimums et peu intégrés qui peuvent être contre-productifs en cas de

nouvelles formes de catastrophes. Il manque une plate-forme commune où toutes les agences de gestion et de réduction des catastrophes pourraient accéder à l'information pour compléter le système actuel d'alarme (sirènes, appels téléphoniques) et améliorer le temps de réponse. Le système actuel peut conduire à des conflits interagents du fait la duplication des rôles comme cela a été montré lors d'inondation dans certaines régions des Émirats arabes unis.

Les Emirats Arabes Unis et Abou Dhabi doivent également innover dans de nouvelles stratégies d'évaluation des risques car les risques varient. Par conséquent, les EAU devraient créer un nouveau réseau d'information sur les dangers passés, actuels et futurs et leur probabilité de causer des dommages aux niveaux local, national et régional. Un examen de la HFA est un point de départ plausible pour cet exercice. De plus, une telle innovation devrait combiner les risques et leur probabilité d'avoir un impact démographique.

De plus, les Émirats arabes unis et Abou Dhabi ont besoin d'une innovation de liste de toutes les catastrophes passées, de leur gestion, des résultats et de leur probabilité de récurrence afin que les nouvelles générations de population puissent prendre conscience des mesures appropriées. Les administrations doivent également recueillir des informations auprès des témoins des différentes catastrophes afin qu'elles puissent participer collectivement au processus d'évaluation et à signaler les événements possibles. Une telle innovation permettra également d'économiser les ressources du gouvernement car des informations viendront du terrain. Cette stratégie doit être envisagée sur le long terme dans des domaines comme la gestion des risques de réchauffement climatique et de sécheresse.

Les EAU et le gouvernement d'Abou Dhabi ont besoin d'une base de données accessible aux membres du public tant qu'ils sont d'alphabétisation primaire. Une telle base de données peut mettre à jour l'information en temps réel sur le statut de risque national, régional et international et sur leurs vulnérabilités de la population des EAU. En outre, du fait qu'Abou Dhabi compte des millions d'expatriés internationaux et de migrants, une telle base de données devrait être dans les principales langues

internationales pour faciliter la compréhension et la communication des contenus. La base de données devrait également contenir d'autres documents éducatifs et des documents de conférence auxquels le public peut accéder pour acquérir des connaissances supplémentaires sur les risques de catastrophe. En outre, les organisations qui effectuent des exercices d'urgence devraient avoir une interface pour informer le public de leurs intentions et des résultats afin que la confiance du public puisse s'appuyer sur la préparation aux catastrophes. Les Emirats Arabes Unis et Abou Dabi doivent intégrer les possibilités de formation aux niveaux communautaire, institutionnel ou organisationnel pour améliorer les individus et le groupe Compétences pour gérer différents types de catastrophes. Après chaque séance de formation successive, les organismes d'urgence et de sauvetage respectifs doivent recruter des volontaires pour diriger les risques de catastrophe et les processus de gestion lors de tout événement. Ces initiatives de bénévolat doivent avoir un équilibre entre les sexes et inclure les femmes. Afin de renforcer la gestion et la réduction des risques de catastrophe, les EAU et Abou Dabi doivent rationaliser les ressources et l'information afin que les actions bénéficient d'un soutien scientifique. Les ressources requièrent des structures à court, moyen et long terme pour éviter les gaspillages ou la pénurie lorsque le temps réel pour la gestion des catastrophes vient appeler. Dans l'ensemble, les Émirats arabes unis et Abou Dhabi ont besoin d'une plate-forme standard pour communiquer les indicateurs de risque internationalement acceptables et les tendances d'observation, de sorte que moins de ressources soient utilisées finalement dans la prévention et la réduction que l'atténuation réelle.

Les EAU et Abou Dabi en particulier doivent examiner le cadre de responsabilisation national, régional, local et traditionnel en cas de catastrophe. Il est nécessaire d'assurer au public que les systèmes existants de responsabilisation en cas de catastrophe soient opérationnelles, rentables et gérés par un personnel dédié et fiable. Certains des ministères ou secteurs qui doivent être inclus dans le cadre de responsabilisation en cas de catastrophe comprennent le tourisme, la marine, l'agriculture, les transports, les finances, la communication, la santé et d'autres qui sont essentiels à la croissance

économique. De plus, les Émirats arabes unis et le gouvernement d'Abu Dhabi doivent réexaminer les cadres législatifs et juridiques concernant les catastrophes.

Les entrepreneurs doivent avoir obligation de rendre compte des catastrophes, par exemple pour les glissements de terrain à proximité des routes principales, des chemins de fer ou de l'aéroport en raison du travail effectué sur ces sites. L'essentiel d'un tel examen est de s'assurer que les populations sont à l'abri des dommages, des blessures ou des décès si les experts responsables ou les organismes de contrôle appliquent des codes spécifiques. Il est nécessaire de réfléchir à un nouveau cadre de transfert des risques, qui diminue les coûts d'atténuation assurés par les finances publiques. Dans l'ensemble, toute nouvelle stratégie de responsabilisation contre les risques doit couvrir les projets en cours et terminés, y compris les étapes de réhabilitation après la catastrophe.

Les EAU et Abou Dhabi doivent innover pour moderniser leur système de santé afin qu'il puisse faire face à toutes les formes de catastrophes. L'expérience antérieure, en particulier lors des inondations et des tremblements de terre, montre que les établissements médicaux étaient trop éloignés ou avaient des lacunes de coordination. En outre, alors que la plupart des établissements de soins de santé sont plus préparés aux blessures physiques, le gouvernement d'Abou Dhabi doit faire davantage pour les former avec des conseillers psychosociaux et du personnel médical, car la plupart des gens souffrent souvent de traumatismes et de dépression après une catastrophe. Chaque année, les Émirats arabes unis et Abou Dhabi doivent augmenter les budgets financiers pour compenser ou aider les victimes de différents types de catastrophes afin qu'ils puissent retrouver la vie productive dans les plus brefs délais.

Les EAU devraient veiller à ce que les procédures d'urgence nationales et régionales soient opérationnelles et que le personnel partage ses expériences et ses difficultés afin que les services puissent s'améliorer avec le temps. Il est nécessaire de créer un forum pour examiner chaque catastrophe ou opérations d'urgence afin de déterminer des problèmes comme le temps de réponse et l'efficacité de l'agence. En outre, les Émirats arabes unis doivent disposer d'un système d'évaluation de la qualité des services, qu'ils

soient nationaux ou internationaux. Certains des critères de qualité fiables sont les directives SPHERE et IASC. Les Émirats arabes unis doivent créer des capacités de préparation aux catastrophes en s'alignant vers des institutions universitaires ou régionales. Afin d'améliorer la réponse générale aux catastrophes aux Émirats arabes unis et à Abou Dabi, il existe des possibilités de formation du personnel et du renforcement des capacités au Centre régional pour la formation et la recherche sur la réduction des risques de catastrophe (RCDRR), établi au Caire. Enfin, les Émirats arabes unis doivent créer un cadre pour faire face aux catastrophes internationales, qui interviennent dans une nation voisine et peuvent menacer son territoire et ses populations.

Les Émirats arabes unis ont déjà améliorés les mesures en vigueur. Il s'agit notamment des objectifs du Millénaire pour le développement (OMD), du cadre d'action de Hyogo 2005-2015 entre autres. D'autres organisations qui jouent un rôle important dans la réponse aux catastrophes aux Émirats arabes unis comprennent l'Académie arabe pour la science, la technologie et les transports maritimes (AASTMT) ou le Centre arabe pour l'étude des zones arides et des terres arides (ACSAD). En outre, l'Organisation arabe pour le développement agricole (AOAD), l'Organisation arabe du travail (ALO) et l'Organisation éducative, culturelle et scientifique de la Ligue arabe (ALECSO) ont pris d'importantes mesures récemment.

Les Émirats arabes unis ont un rôle à jouer dans le renforcement du bien-être socio-économique de ses populations en menant à la mise en œuvre de diverses stratégies visant à réduire les risques. Le gouvernement étant engagé dans des partenariats internes et externes, cela constitue une force car ceux-ci se complètent mutuellement et permettent que le pays résiste mieux aux prochaines catastrophes. Avec les synergies en cours, les Émirats arabes unis disposent d'une meilleure utilisation des ressources d'urgence et de sauvetage au cours du processus de gestion des catastrophes. En outre, l'approche inter-agence est une force pour les Émirats arabes unis parce que la nation est unie pendant les moments difficiles et la cohésion sociale. L'utilisation de différentes organisations dans la réduction et la gestion des risques des EAU offre les meilleures

compétences techniques, car il existe une spécialisation ou des rôles et une meilleure répartition des ressources.

Mots Clefs:

Dangers naturels, risques non naturels, risques industriels, prévision du risque, Gestion des risques, Organisation administrative, Émirats arabes unis, États du Golfe.

Abstract

Disasters, a vigorous mankind interaction with nature. Regardless of its various motivators, human beings have sought methods to minimize its devastating effects. Social and economic development are major contributors to increasing disasters' vulnerability, therefore, studying risks associated to natural and non-natural disasters provides means that could be utilized in the forecasting and management of risks on both natural and non-natural sides.

This research aims to analyze how disaster risk management process has been built in the emirate of Abu Dhabi, United Arab Emirate, by the different stakeholders in charge whether on public or private actors. The UAE vulnerability to disasters is increasing with the huge development industrial activities taking place at the present. Furthermore, tectonic and weather related disasters are becoming very common in the UAE. Different types of disasters affect the UAE population and stretch the government and inter-agency resources as they all respond to the emergencies.

The study came across many conclusions in regards to UAE continuous system of risk assessment and risk management. Many recommendations are listed for further investigation and implementation

Finally, the national and regional emergency procedures are key factors to mitigate or increase disasters' impact on regions.

Key Words:

Natural Hazards, Non-Natural Hazards, Industrial Risk, Risk Forecasting, Risk

Management, Administrative Organization, United Arab Emirates, Gulf States.

Declaration

I declare that this thesis entitled "Disaster Risk Reduction in Abu Dhabi, the Capital of the United Arab Emirates, Effects of Natural and Non-Natural Disaster over Business Continuity and Sustainability" submitted in partial fulfillment of the degree of Doctor of Philosophy is a record of original work carried out by me under the supervision of Professor Philippe Cadene, and has not formed the basis for the award of any other degree or diploma, in this or any other institutions or university. In keeping with the ethical practices I reporting scientific information, due acknowledgment have been made wherever the findings of others have been cited.

Ahmed Ali Al Marzooqi

Dedication

I dedicate my work to those who spare no efforts to assist me; my parents, my wife, Khadija and all my children; Ali, Fatima, Khalid and Abdulaziz for their endless support throughout all years of my study.

This work is dedicated to our beloved country and our honored leaders of the United Arab Emirates.

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Abbreviations

	Abbreviation	Meaning
<i>I</i>	FACT	Field Assessment and Coordination Teams
<i>II</i>	ICRC	International Committee of the Red Cross
<i>III</i>	UNCCD	United Nations Convention to Combat Desertification
<i>IV</i>	ISDR	International Strategy for Disaster Reduction
<i>V</i>	UN	United Nations
<i>VI</i>	ICRC	International Committee of Red Cross
<i>VII</i>	WHO	World Health Organization
<i>VIII</i>	CRED	Center for Research on the Epidemiology of Disasters
<i>IX</i>	CBD	Convention of Biodiversity
<i>X</i>	NGO	Non-Governmental Organizations
<i>XI</i>	UAE	United Arab Emirates
<i>XII</i>	GCC	Gulf Cooperation Council
<i>XIII</i>	INCAE	Institute Centro Americano de Administration de Empresas
<i>XIV</i>	EM-DAT	Emergency Events Database
<i>XV</i>	OFDA	The Office of Foreign Disaster Assistance
<i>XVI</i>	DRM	Disaster Risk Management
<i>XVII</i>	DRR	Disaster Risk Reduction
<i>XVIII</i>	GFDRR	Global Facility for Disaster Risk and Reconstruction
<i>XIX</i>	IFRCRCS	International Federation of Red Cross and Red Crescent Societies
<i>XX</i>	NCEMA	National Crises Emergency Management Authority
<i>XXI</i>	BCM	Business Continuity Model
<i>XXII</i>	CSR	Corporate Social Responsibility
<i>XXIII</i>	HDI	Human Development Index

XXIV	GDP	Gross Domestic Product
XXV	MOPW	Ministry of Public Works
XXVI	MoE	Ministry of Education
XXVII	MOPW	Ministry of Public Works
XXVIII	ROPME	Regional Organization for the Protection of the Marine Environment / Kuwait
XXIX	UNISDR	United Nation Office for Disaster Risk Reduction

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Executive Summary

Disasters have always been a result of human interaction with nature, technology and other living entities. Sometimes unpredictable and sudden, sometimes slow and lingering, various types of disasters continually affect the way in which we live our daily lives. Human beings as innovative creatures have sought new ways in which to curb the devastating effects of disasters. However, for years human conduct regarding disasters has been reactive in nature. Communities, sometimes aware of the risks that they face, would wait in anticipation of a disastrous event and then activate plans and procedures. Human social and economic development has further contributed to creating vulnerability and thus weakening the ability of humans to cope with disasters and their effects.

Disasters impede human development. Gains in development are inextricably linked to the level of exposure to disaster risk within any given community. In the same light, the level of disaster risk prevalent in a community is linked to the developmental choices exerted by that community (UNDP, 2004). The link between disasters and development is well researched and documented. The fact that disasters impact on development (e.g. a school being washed away in a flood) and development increases or decreases the risk of disasters (e.g. introducing earthquake-resistant building techniques) is widely accepted. Yet, every year Africa suffers disaster losses which set back development and leave our communities living in a perpetual state of risk.

Disasters are not new to humankind. The earliest of humans have witnessed, experienced, perished and survived many disasters like, forest fires, tsunamis, deluge, inundation, massive landslides etc. There is ample evidence in the literature and in the contemporary web world on the submergence of huge tracts of land due to the occurrence of natural furies such as deluges and tsunamis. Due to frequent occurrence of disasters at different location of the world, these have become accustomed to peoples' lives. Such frequent disaster incidences tend to disrupt normal human lives because resources and attention has to shift to their mitigation measures.

In the contemporary world, industrialization has brought in its wake innumerable woes and untold miseries to the people in terms of industrial disasters, like fires, explosions, toxic gas releases not to mention the greenhouse phenomena or the El Nino effect. Today, the mankind is faced with the challenge of braving both the natural and the man-made industrial disasters.

Turning to the current century, disasters have been more complex compared to earlier days. These complexities are evident from the unpredictability of the natural disasters to the environment and the frequency of man-made disasters and drawback to economies and humankind. There are strong views that more industrialized nations such as the UAE, tend to face more man-made disasters as compared to its counterparts. Some of the man-made disasters associated with industrialized nations of the world include wild fires, facility explosions and nuclear leakages to mention a few.

This study prefers to evaluate the ramifications of the natural and man-made disasters beyond monetary value as a departure from past trends, picking from 2005 to 2015. The collective evidence of disaster consequences underpins our choice and scope of study in the context of Abu Dhabi, the UAE, GCC, the Arab World and the international society worldwide. In the UAE, various government and non-governmental organizations have mandate to supervise public and private activities with potential of causing imbalance in the environment leading to different disasters. Throughout this paper, there will be consideration of how disaster risk management (DRM) can be enhanced in the UAE.

Some of the common effects of disasters include displacement of human dwellings, social stresses and economy slowdown as resources are diverted from growth to recovery objectives. For that matter, disasters tend to disturb the normal businesses operations and it is upon the respective entities to ensure there are competent structures to respond in time. Some of the common structures that businesses can set up proactively are health and safety systems, establishing environmental friendly area of work, producing acceptable quality products and review of existing or new policies.

A typical disaster management policy that any business should have must include the organizations preparedness for any events, their mitigation strategies, the risk minimization plan, recovery from the aftermath, communication of the events to attract appropriate response and rebuilding of the damages assets. This implies that the business must have an active planning committee or focus group; an action and organizing group; and designated leaders to deal with any disasters without undue delays. Therefore, this study focuses on the aspects of business continuity in the aftermath of any disastrous event that will have any ramifications for the business.

This research work aims to analyze how DRM process has been built in the emirate of Abu Dhabi by the different stakeholders in charge. It intends to understand how this important issue could be taken over in the last decades, either by public than private actors, and, obviously, how appears to be the situation today.

In order to address these questions, the research will first analyze the Abu Dhabi government's structures, responsibilities and procedures for managing disasters and reducing their associated risks. It will then assess the Abu Dhabi people's awareness and vulnerability of the area to different types of natural and non-natural risks. It will finally determine the perception of disasters among Abu Dhabi businesses community and articulate ways of sustaining continuity in collaboration with the government support in the wake of natural and non-natural disasters.

The hypotheses drawn for standing the approach are the following:

- During the decades under study, which is the period of the development of the new State, the emirate of Abu Dhabi in specific and the entire country in general, the UAE has faced increasing numbers of geological hazards, climatic and environmental catastrophes, biological and man-made crisis, industrial and infrastructural disasters;
- Each of these events had some qualified and quantified economic and financial costs aside from their disruption of the normal human lives and functions, and became an increasing public and institutional concern, specifically because while

some disasters in the UAE are irreparable, the diversion of human lives and functions is an underlying challenge because the risk could have been underestimated from the beginning;

- If the UAE government and the NGOs take a proactive role in averting especially the non-natural disasters as the physical costs and conservation of human lives are must forward looking, but the distinction between natural as well as non-natural disasters seems to be narrowing every decade.

The methodology adopted for the research is the exploratory approach. Historical data available in the print and web literature on the natural and non-natural disasters were used in the research. The primary data for the research was obtained through interviews, survey questionnaire, checklist etc. Self-assessment questionnaires, Survey questionnaire, HFA Benchmark analysis checklist etc. were developed for this purpose. Analysis of these data using methods like “Content Analysis”, “SWOT Analysis”, “Gap Analysis” and “Risk Assessment Analysis” was carried out to arrive at the findings and conclusions.

This study is arranged into the following four parts:

The First part is devoted to present the historical information about natural and non-natural disasters while also defining disaster in the various perspectives, namely, technological, political, economic, cultural and religious. The types of disasters and the global trend of disasters are also presented in this part of the thesis.

The Second Part gives a brief account of the political, geographical, administrative and governance features of the Emirate of Abu Dhabi vis-a-vis, the Abu Dhabi Economic Vision 2030 and its objectives, present the geography and vulnerability to disasters in the UAE and Abu Dhabi . It takes into account the sociology and literacy levels; culture and population aspects of the UAE people in understanding Vulnerability to Disasters and gives a detailed account of natural disasters in GCC and UAE as well as

the lessons learned from these 16 disasters and the path forward to mitigate their effects. Similarly, it gives a detailed account of non-natural disasters in GCC and UAE and analyses why non-natural disasters become more important issue in this region of the world.

The Third Part is devoted to present and discuss the roles and responsibilities of the disaster management institutions in Abu Dhabi. It lists the international organizations concerned about non-natural and anthropogenic hazards and identifies the international disaster mitigation agencies at work in Abu Dhabi, then discusses the roles, responsibilities and the legal instruments that govern them. Moreover, it deals with the disaster administration and management system in GCC, UAE and Abu Dhabi. It specifically identifies the critical and non-critical players of Abu Dhabi involved in the governance of disaster management.

The fourth Part presents the disaster management experiences in Abu Dhabi and the data analyses made. The “Analysis, Findings and Discussion” is devoted for presenting the various analyses made in the report, the findings from those analyses and the discussion concerning the analyses. This part presents the ‘Conclusions’ from the various results of the analysis. The primary data for the research was obtained through interviews, survey questionnaire, checklist etc. Self-assessment questionnaires, Survey questionnaire, HFA Benchmark analysis checklist etc. were also devised. These data were analyzed using methods like “Content Analysis”, “SWOT Analysis”, “Gap Analysis” and “Risk Assessment Analysis’ and the findings are presented in the last Chapters.

We conclude that the UAE has faced numerous natural and non-natural disasters in the two last decades, which justified the conduct of this study to gauge the national and regional preparedness for future eventualities. Among the natural disasters that have befallen the UAE are atmospheric related, anthropogenic and seismic movements. With every successive disaster, the UAE has proved more vulnerable from the impact of such events. Even though data on the UAE disaster are scarce or limited, we were able

to corroborate various qualitative sources with the quantitative findings to arrive reliable conclusions on natural disasters.

Furthermore, we conclude that tectonic and weather related disasters are becoming very common in the UAE owing to the geographical location of the nation. The tectonic movements, other than being natural, are also triggered by the oil drilling and infrastructural construction activities. Significant part of the UAE is a desert and this factor too makes the region extremely vulnerable to sand storms, wash away by the sea waves and flooding. In the last decade alone, there were at least 25 seismic activities recorded by the authorities. Some of the most vulnerable areas are the Zagros Thrust, Masafi and Hurmuz Straits.

Among the non-natural disasters, where Abu Dhabi exhibits great preparedness, is terrorism as a geopolitical problem. Indeed, Abu Dhabi has key installations and infrastructure that are worthy of defense from terror attacks including fires and explosions. The problem of road accidents is also a matter of concern in Abu Dhabi and UAE in general. With this foresight, it is important that different disaster management agencies and public collaborate to minimize negative impact. The process of disaster management in Abu Dhabi and UAE requires both operational and legislative preparedness so that the public have confidence. Additionally, such a measure will safeguard business process continuity, which is a major concern for the people in Abu Dhabi and UAE in general. Taking the example of the nuclear plant at Barakah, it is imperative for the UAE government and disaster management agencies to be prepared in case of any problems. We find that the Ministry of Energy plays a critical role of supporting business recovery and compensations, post disasters.

We find that the UAE has varied experiences of natural and non-natural disasters. Simultaneously, various activities in the UAE have led to environmental degradation, infrastructural developments, and competition for scarce resources. Additionally, shifting demographic features and opening up new settlement schemes each warrants a new and continuous risk management. We find that due to the different natural and non-natural disasters, there are primary and secondary risks that

affect the UAE population. These are not limited to internal mass displacements, transport and communication interruptions, spreading diseases, low quality of life and productivity, food shortage, social strife and unrest. These risks become complicated with time and on wider scale compared to experiences.

We find that different types of disasters affect the UAE population and stretch the government and inter-agency resources as they all respond to the emergencies. We find that some natural and non-natural disasters have immediate effects while others have medium to long-term effects. Some of the disasters lead to permanent displacement of people and their livestock while others call for resettlement after completion of risk assessment by the respective authorities. Some disaster grounds or sites in the UAE are totally unsafe for habitation or business while others are rehabilitated and improved to avert recurrent events.

The UAE government was represented at the 1st Arab Summit on Socio-Economic Development to standardize activities that target risk reduction. During this meeting, the Arab Strategy for Disaster Risk Reduction (ASDRR) was unveiled at two levels:

- To outline a vision, strategic priorities and core areas of implementation for disaster risk reduction in the Arab region;
- To enhance institutional and coordination mechanisms, and monitoring arrangements to support the implementation of the Strategy at the regional, national and local level through preparation of a Program of Action”.

We find that when UAE works along the ASDRR, there will be supplementary action to the national strategies and guidelines for managing disaster risks. At the national levels, there are specific agencies such as Civil Defense, Fire Department, various government ministries and non-government organizations. Additionally, there are international agencies that work along the UAE in times of disasters and these include the World Health Organization, Red Crescent Society, and International Federation for Red Cross, and Weather Satellite organizations among others.

We find that the UAE is working with the Hyogo Framework for Action (HFA) because it has a very robust strategy for risk reduction and specifically endeavors to the following:

- Strengthen commitment for comprehensive disaster risk reduction across sectors.
- Develop capacities to identify, assess and monitor disaster risks.
- Build resilience through knowledge, advocacy, research and trainings.
- Improve accountability for disaster risk management at the sub national and local level.
- Integrate disaster risk reduction into emergency response, preparedness and recovery”.

We established that the UAE has a continuous system of risk assessment and issues to be implemented using the multi-agency teams. Whereas some predictable risks have a timetable of management implementation, others require personnel and resource mobilization in advance to ease response rates as soon as alarms are raised. The UAE currently aligns to the HFA running up to 2015 and with possibility of reviewing targets beyond this period. According to the HFA obligations, we find that the UAE has segmented their tasks under the ASDRR with a target of minimizing destruction to property or assets, loss of lives, slowdown of economic growth, and degradation of environment and disruption of social lives. The UAE is further benefitting from the League of Arab States to implement these risk reduction programs.

We find that the UAE has encountered various disasters, some emanating internally while others are from external sources. These disasters manifest in different ways including volcanic eruptions causing Tsunami, earthquakes, landslides, cyclones, floods, temperature extremes, famine, sand storms, fires, explosions among others. The 2007 Cyclone Gunu that covered all the way to Oman is one of the most memorable disasters that demonstrated why the UAE has to collaborate with multiple agencies to manage effects.

We further find that some environmental activities in the UAE over the decade are to blame for the rapid change in climate. Therefore, the country has experienced rising sea levels, floods, prolonged dry spells and increasing desertification. The onus for the UAE is to ensure that the environmental risk management is in tandem with the rest of the Arab region strategy because some issues such as floods, earthquakes, landslides, sand storms and dry spell are not limited to national borders.

We conclude that whereas some actors are involved directly in disaster management, others work in the background to coordinate activities and ensure linkages for relief of the affected persons or areas. Organizational innovation and resilience define the capacity of Abu Dhabi and UAE to mobilize and respond to every disaster.

There are various critical actors in the Abu Dhabi disaster management process. Among these is the League of Arab States, whose role is offering leadership, support, resources, personnel and expertise for assessing situations. Additionally, the League of Arab States is committed to mobilizing other international actors to assist with humanitarian resources.

We established that Abu Dhabi has regional centers for disaster management and risk reduction. These centers are useful for capacity building and knowledge dissemination among the population about potential disaster risks and ways of overcoming them. Additionally, the UAE has some national authorities involved in the actual disaster management operations. These authorities have national mandate and are required to give periodic reports on the country's state of disaster preparedness. Moreover, the authorities strive to work with communities and businesses to establish a safe environment including supporting legislative framework, policies, rules and regulations.

Abu Dhabi has various civil society organizations, which are directly involved in disaster management and risk reduction. These include the International Red Cross Association, the Red Crescent and other non-profit community based organizations. These organizations are integrated under the ASDRR under the government oversight at

regional, national and local levels. These organizations are tasked with coordinating disaster rescue and recovery efforts including provision of relief materials and other relevant assistances

Abu Dhabi is involved with numerous international organizations during disaster management and risk reduction process. These partners complement each other activities to ease the disaster stress and risk impact to the population and their property. Some of these partners are specialist in areas of disaster management and risk reduction for example in transport, housing, health, water and industrial sectors among others. Overall, the international partners are specialized in the following areas: “capacity development, trainings, knowledge management, risk assessments, integration of disaster risk reduction in the environment, health and education sectors, supporting the coordination and harmonization of disaster risk reduction tools at national and local levels, among others”.

We find that the less critical actors in disaster governance include communal groups and teams whose intentions are findings ways of reducing risk at home or around their society. These include women, youth and men groups who have some economic or social agenda, but include disaster reduction and management as a key concern. The role of non-critical actors is important in grass root sensitization of risks, so that cost on disaster management can reduce significantly. Approximately 10% of relief funds support these non-critical actors in disaster management especially towards the post disaster occurrences. Additionally, the non-critical actors are useful for enforcing quality services during disaster management because they provide feedback on gaps or measures that need improvement in future.

The UAE must widen the partnership of bodies of risk reduction starting with the national policy framework, review of existing strategies and legal support so that all gaps are eliminated, going forward. The current risk management policies require in-depth assurance in areas like poverty reduction and supporting multi-national diversity created by the international migrants in urban areas. Moreover, the existing policies require proactive awareness campaigns and regular information to the public to know

what to do whenever different types of disasters occur in the UAE. The new policy must address issues of demographic vulnerability especially the children and women whenever certain disasters occur and the priority to be given accordingly. Even though there are specialized emergency bodies activated whenever there is disease outbreak or public health concerns, there is need to innovate faster ways of communicating with the people and sending regular updates. Perhaps, with the penetration of mobile phones, could supplement the radios and other modes of mass communication to report and react to cases.

The UAE and Abu Dhabi leadership needs to innovate ways of communicating climate change and impact to the public so that their subsequent calls for better environmental conservation can embrace with minimal resources. Additional resources must back the current state of using satellite to monitor the climate change so that all the environmental partners can be informed of the priorities for risk management and reduction. Moreover, the UAE must innovate ways of decentralizing the information by including the population if regular updates on issues, responsibilities and timetable of implementation. Currently, the UAE and Abu Dhabi government have some sort of narrow information and data stream that may be counterproductive during emergence of new forms of disasters. If the UAE and Abu Dhabi can innovate a common platform where all the disaster management and reduction agencies can access information to supplement the current alarm / siren/ telephone call system, then the response time can greatly improve. The current system can lead to some interagency conflicts as was indicated by duplication of roles during flooding events in parts of UAE.

The UAE and Abu Dhabi must innovate new risk assessment strategies that cover the national and regional details because risks vary geographically. Specifically, the trends in migration to the urban areas with more job opportunities have implication that new risk will emerge in due course and must mitigate timely before problems escalate to wider areas⁵⁹⁸. Therefore, the UAE should innovate a new network for information of past, current and future hazards and their likelihood of causing harm to the public at local, national and regional scope. A review of the HFA is a plausible starting point for this

exercise. Moreover, such an innovation should combine risks and their likelihood to impact demographically.

The UAE and Abu Dhabi need to mobilize the public understanding of different disasters so that they may collectively participate in the assessment process and reporting of likely events. Such an innovation will also save the government resources because proactive information will be coming from the ground. Therefore, implementation of the risk reduction strategies will have a high buy-in by the population. This strategy is more progressive in areas like managing risks of global warming and drought because the population on the ground will be informed on what to do timely. The UAE needs to innovate on better early warning approaches given that some disasters have primary and secondary hazards. Previously, the respective agencies have been focusing on the primary problems, oblivious of the escalations in future. Additionally, the UAE and Abu Dhabi need an innovation of roster of all the past disaster, their management, the outcomes and their likelihood of recurrent so that new generations of population can be aware of appropriate action.

The UAE and Abu Dhabi government require a database, which is accessible to members of the public as long as they are of primary literacy level. Such a database can update information real time on the national, regional and international risk status and their vulnerabilities of the UAE population. Moreover, since Abu Dhabi has millions of international expatriates and migrants, such a database should be in the leading international languages to ease understanding and communication of contents. The database should also have additional educative materials and conference papers that the public can access to gain additional knowledge on disaster risks. Furthermore, organizations doing emergency drills should have an interface to inform the public of their intentions and the outcomes so that public confidence can build on disaster preparedness UAE and Abu Dhabi need to integrate training opportunities at community, institutional or organizational levels to improve individual and group skills in handling different types of disasters. After each successive training session, the respective emergency and rescue agencies need to recruit volunteers to lead disaster

risk and management process during any events. Such volunteer initiatives must have gender balance and include women. In order to strengthen the disaster risk management and reduction, the UAE and Abu Dhabi need to streamline resources and information so that the actions have scientific backing. The resources need short, medium and long-term structures to avoid wastage or scarcity when the actual time for disaster management comes calling. Overall, the UAE and Abu Dhabi need a standard platform for communicating the internationally acceptable risk indicators and observing trends so that fewer resources are utilized eventually in prevention and reduction than actual mitigation.

The UAE and Abu Dhabi in particular need to review the national, regional, local and traditional disaster accountability framework. There is need to assure the public that the existing disaster accountability systems are operationally sound, cost effective and managed by dedicated and reliable personnel. Previously, there has been a ministerial or organizational style of disaster accountability. However, these units need to be re-innovated to be more responsive and economical without compromising critical information. Some of the Ministries or sectors that need to be included in the disaster accountability framework include Tourism, Marine, Agriculture, Transport, Finance, Communication, Health and others critical to the economic growth. Moreover, the UAE and Abu Dhabi government need to review the legislative and legal accountability for disasters because some have serious effects on new or ongoing projects such as multi-billion worth of infrastructure.

All quantity and quality planners, surveyors and contractors need a reviewed accountability for disasters, for example for landslides next to major roads, railways or airport because of the work at these sites. The essence of such a review is to ensure that populations are safe from harm, injury or deaths if the responsible experts or oversight bodies enforce specific codes. The ability to study current and future financial frameworks for projects can reveal whether there is sufficient insurance during disasters while the project is ongoing or much later after commissioning to use. Therefore, the UAE and Abu Dhabi government need to innovate a new risk transfer framework, which

cushions the public resources from mitigation costs. Overall, any new risk accountability strategy must cover ongoing and completed projects including the rehabilitation steps post disaster.

The UAE and Abu Dhabi need to innovate ways of responding to the natural and non-natural disasters. Previously, there has been an alarm, siren and radio system of communication. However, this can have challenges to members of the public who have various disabilities, whether audio, visual, mobility or a combination of sorts, internally displaced persons and those with special needs. There is urgent need to review the existing policy so that different disaster management institutions can be effective in addressing every new challenge or diversity of old. Whereas the individual institutions have a disaster preparedness framework, there are differences on the way the public is engaged, especially the women and children, yet they too can be instrumental in risk reduction and management.

The UAE and Abu Dhabi must innovate to modernize healthcare support that can cope with all forms of disasters. Previous experience especially during flooding and earthquake shows that the medical facilities were over stretched or had coordination gaps. Moreover, whereas most of the healthcare facilities are more prepared for physical injuries, the Abu Dhabi government must do more to staff them with psychosocial counselors and medical personnel since most people often suffer trauma and depression post disaster. Annually, the UAE and Abu Dhabi need to increase the financial budgets for compensating or assisting victims of different types of disasters so that they can get back to productive life within the shortest time.

The UAE should ensure that the national and regional emergency procedures are operational and the staff share experiences and challenges so that services can improve over time. There is need for a forum to review each disaster or emergency operations to ascertain issues like response time and agency effectiveness. Moreover, the UAE needs to have a credible service quality evaluation system, whether national or international based. Some of the reliable quality benchmarks are SPHERE and IASC guidelines. The UAE needs to build capacity of disaster preparedness by aligning to university or

regional institutions. Among the mandatory trainings required are capacity to evaluate damage and loss of lives. In order to improve the general disaster response in UAE and Abu Dhabi, there are opportunities for training personnel and capacity building at the Regional Centre for Disaster Risk Reduction Training and Research (RCDRR), established in Cairo. Finally, the UAE needs to innovate a framework for addressing international disasters that starts in a neighboring nation and threatens others. The aim of such a caucus is coordinate response teams, improve preparations and shorten the recovery time.

The UAE has reacted to the rising statistics of disasters by entrenching various frameworks and treaties. These include Millennium Development Goals (MDGs); the *Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters* at the World Conference on Disaster Reduction held in Kobe, Japan 2005 among others. Other organizations that have active role in the disaster response in the UAE include the LAS such as the Arab Academy for Science, Technology and Maritime Transport (AASTMT), the Arab Centre for the Study of Arid Zones and Dry Lands (ACSAD). Additionally, the Arab Organization for Agricultural Development (AOAD), the Arab Labor Organization (ALO) and the Arab League's Educational, Cultural and Scientific Organization (ALECSO) have been very conspicuous lately⁶⁰⁸. However, the UAE has certain strengths and weaknesses as the government seeks to identify risks and implement the management steps under a multi sector approach to minimize related risks.

We find that the UAE has a role in strengthening the socio-economic welfare of its people by leading in the implementation of various strategies aiming at risk reduction. Since the UAE allows internal and external partnership, this as strength because they complement each other's capacities and ensure the country is resilient in tackling fresh disasters. Whenever such synergies are drawn, the UAE has better utilization of emergency and rescue resources during disaster management process. Moreover, the inter agency approach is a strength for the UAE because the nation stands united during trying moments and there is social cohesion. The utilization of different organizations in

UAE risk reduction and management provides the best technical skills, as there is specialization of roles and better spread of resources. Additionally, the inter agency approach is more effective for risk monitoring, evaluation and mitigation process.

Among of the key weakness of UAE and Abu Dhabi in disaster risk management is inability to tackle some secondary effects of the natural and non-natural disasters. This report has showed that there are instances when the designated emergency agencies are inadequate in managing the seismic events, pollution and degradation, protecting endangered species, water availability and distribution. Other weaknesses of the UAE and Abu Dhabi include inadequate capacity to mitigate global warming effects, predict cyclones and communicate their impacts, construct dykes and walls near dams to prevent flooding and stop poor land use leading to rapid desertification.

Due to these weaknesses, the UAE and Abu Dhabi population have experienced systematic or abrupt secondary risks. These include rapid depletion of food and water resources in the urban and rural regions, disruption in the demographics as more international migrants come to fill the labor opportunities, Similarly, there have been springing of new unplanned settlement schemes yet these could be lying on landslide regions and expose the residents to future risks. The rapid international migrations to the UAE are causing serious transport and communication challenges to the country's existing infrastructure, which has forced the government to carry out several upgrades regularly.

The UAE and Abu Dhabi has some civilian governance problems due to the rapid increase in population and local have some tension with the expatriates for taking up their opportunities. The social amenities are either crowded or overstretched in the UAE and Abu Dhabi. These include medical facilities and there is fear that disease outbreak could affect very many people in the densely populated areas. Specifically, Abu Dhabi has been grasping with the public health issues over the last decade as more people move to the area.

GENERAL INTRODUCTION

The Preamble

Disasters are not new to humankind. The earliest of humans have witnessed, experienced, perished and survived many disasters like, forest fires, tsunamis, deluge, inundation, massive landslides etc. There is ample evidence in the literature and in the contemporary web world on the submergence of huge tracts of land due to the occurrence of natural furies such as deluges and tsunamis. Stories abound on the submergence of Atlantis in the Mediterranean Sea and the Lemuria or Kumari Kandam in the southern tip of India running into the Indian Ocean. In fact, it is from such experiences that the humankind has learned and mastered the art of conquering the nature. In the contemporary world, industrialization has brought in its wake innumerable woes and untold miseries to the people in terms of industrial disasters, like fires, explosions, toxic gas releases not to mention the greenhouse phenomena or the El Nino effect. Today, the mankind is faced with the challenge of braving both the natural and the man-made industrial disasters. The byproduct of such disasters includes large scale destruction of lives, economy as well as the natural and built environment.

Due to frequent occurrence of disasters at different location of the world, these have become accustomed to peoples' lives. Such frequent disaster incidences tend to disrupt normal human lives because resources and attention has to shift to their mitigation measures. Otherwise, different natural and man-made disasters have the capacity of affecting not only social activities and human health but also leave a massive impact on economic growth, political alignments and environmental settings. Experience has shown that disasters or their impacts can mitigate with proper risk assessment and timely management. It is in this larger context that the impetus for this research has been found.

In the wake of a large number of disasters, both natural and man-made, occurring world over, the subject of disaster risk management is gaining more and more significance. Progressive nations have put in place disaster control mechanisms and continuously upgrade them as more and more lessons are learned in the successive disasters. The Indian Ocean Tsunami Warning System set up after the 2004 Indian Ocean earthquake and the subsequent Tsunami, on the lines of the Hawaii based Pacific Tsunami Warning Centre in the Pacific Ocean is one such example. The importance of early warning systems for the impending catastrophes has been recognized world over.

Various international organizations have joined hands for the cause of disaster risk mitigation and control. A detailed account of the roles and responsibilities of these organizations vis-à-vis their interface role with other similar organizations has been taken in this research study.

Turning to the current century, disasters have been more complex compared to earlier days. These complexities are evident from the unpredictability of the natural disasters to the environment and the frequency of man-made disasters and drawback to economies and humankind. There are strong views that more industrialized nations such as the UAE, tend to face more man-made disasters as compared to its counterparts. Some of the man-made disasters associated with industrialized nations of the world include wild fires, facility explosions and nuclear leakages to mention a few. Therefore, respective global national governments have the responsibility of formulating strong policies to monitor, address and prevent such man-made disasters going forward. Such policies integrate laws, regulations and good business practices to be successful in managing associated risks and general premise safety.

This study prefers to evaluate the ramifications of the natural and man-made disasters beyond monetary value as a departure from past trends, picking from 2005 to 2015. The collective evidence of disaster consequences underpins our choice and scope of study in the context of Abu Dhabi, the UAE, GCC, the Arab World and the international society worldwide. In the UAE, various government and non-governmental organizations have mandate to supervise public and private activities with potential of causing imbalance in the environment leading to different disasters. Throughout this paper, there will be consideration of how disaster risk management (DRM) can be enhanced in the UAE.

The impacts of the disasters on the business continuity have also been considered in this study. Business investors need to understand the magnitude of disruption that they may encounter for their businesses due to disasters and make proper investment planning. Prior planning and evaluation of the sites to locate businesses must be comprehensive if businesses want to survive such disastrous events. A business risk analysis is paramount to check if the business is sustainable against the possibilities of tornadoes, hurricanes, droughts, fires, floods and other types of hazards. Each of these issues has some relationship with global warming, energy and fuel costs, resource scarcity, water

shortages, population issues, ecosystem issues, and deforestation. It is anticipated that this study will provide some valuable insight for the business leaders in their business siting considerations. Business leaders will be able to ponder over the cyclical relationship of these factors and decide on the best way to reduce their impact.

Some of the common effects of disasters include displacement of human dwellings, social stresses and economy slowdown as resources are diverted from growth to recovery objectives. For that matter, disasters tend to disturb the normal businesses operations and it is upon the respective entities to ensure there are competent structures to respond in time. Some of the common structures that businesses can set up proactively are health and safety systems, establishing environmental friendly area of work, producing acceptable quality products and review of existing or new policies.

Many businesses often lack a disaster management policy, hence, the impact to their businesses drags on longer than expected. Additionally, many businesses tend to have disaster management policy that covers non-natural disasters while ignoring the natural situation on the pretext that the latter is unpredictable. A typical disaster management policy that any business should have must include the organizations preparedness for any events, their mitigation strategies, the risk minimization plan, recovery from the aftermath, communication of the events to attract appropriate response and rebuilding of the damages assets. This implies that the business must have an active planning committee or focus group; an action and organizing group; and designated leaders to deal with any disasters without undue delays. Therefore, this study focuses on the aspects of business continuity in the aftermath of any disastrous event that will have any ramifications for the business.

This research work aims to analyze how DRM process has been built in the emirate of Abu Dhabi by the different stakeholders in charge. It intends to understand how this important issue could be taken over in the last decades, either by public than private actors, and, obviously, how appears to be the situation today.

Abu Dhabi is one of the six emirates which form the United Arab Emirates (UAE), a federal State which got its Independence from the British in 1971 only. In a short period of time, the UAE government, as well as the citizens, had a challenging task to build an entire economic system, a social well-fare organization and a full range of rules and

regulation. Some questions rise from this experience after less than fifty years, Is Abu Dhabi government efficiently prepared for natural and non-natural crises and disasters' mitigation After this short period, do Abu Dhabi business stakeholders maintain sufficient capabilities to carry out natural and non-natural risk assessment and to manage the associated hazards.

In order to address these questions, the research will first analyze the Abu Dhabi government's structures, responsibilities and procedures for managing disasters and reducing their associated risks. It will then assess the Abu Dhabi people's awareness and vulnerability of the area to different types of natural and non-natural risks. It will finally determine the perception of disasters among Abu Dhabi businesses community and articulate ways of sustaining continuity in collaboration with the government support in the wake of natural and non-natural disasters.

The hypotheses drawn for standing the approach are the following:

- During the decades under study, which is the period of the development of the new State, the emirate of Abu Dhabi in specific and the entire country in general, the UAE has faced increasing numbers of geological hazards, climatic and environmental catastrophes, biological and man-made crisis, industrial and infrastructural disasters;
- Each of these events had some qualified and quantified economic and financial costs aside from their disruption of the normal human lives and functions, and became an increasing public and institutional concern, specifically because while some disasters in the UAE are irreparable, the diversion of human lives and functions is an underlying challenge because the risk could have been underestimated from the beginning;
- If the UAE government and the NGOs take a proactive role in averting especially the non-natural disasters as the physical costs and conservation of human lives are must forward looking, but the distinction between natural as well as non-natural disasters seems to be narrowing every decade.

Using a participatory methodological approach

The methodology adopted for the research is the exploratory approach. Historical data available in the print and web literature on the natural and non-natural disasters were used in the research. The primary data for the research was obtained through interviews, survey questionnaire, checklist etc. Self-assessment questionnaires, Survey questionnaire, HFA Benchmark analysis checklist etc. were developed for this purpose. Analysis of these data using methods like “Content Analysis”, “SWOT Analysis”, “Gap Analysis” and “Risk Assessment Analysis’ was carried out to arrive at the findings and conclusions.

The organization of the thesis

The thesis is arranged into the following four parts.

PART 1: Disasters: A Social and Scientific Issue at the World Level

PART 2: Disasters in Abu Dhabi

PART 3: Disaster Management Institutions in Abu Dhabi

PART 4: Disaster Management Experiences in Abu Dhabi

The Part 1, consisting of three chapters, is devoted to present the historical information about natural and non-natural disasters while also defining disaster in the various perspectives, namely, technological, political, economic, cultural and religious. The types of disasters and the global trend of disasters are also presented in this part of the thesis. Chapter 1 presents the broad objective of the study and the methodology adopted for this study. The Chapter 2 and the Chapter 3 analyze the historical details of natural and non-natural disasters in the global and regional context respectively.

Part 2 consists of four chapters. The Chapter 4 gives a brief account of the political, geographical, administrative and governance features of the Emirate of Abu Dhabi vis-a-vis, the Abu Dhabi Economic Vision 2030 and its objectives. Chapter 5 has been devoted to present the geography and vulnerability to disasters in the UAE and Abu Dhabi . It takes into account the sociology and literacy levels; culture and population aspects of the UAE people in understanding Vulnerability to Disasters. Chapter 6 gives a detailed account of natural disasters in GCC and UAE as well as the lessons learned from these

disasters and the path forward to mitigate their effects. Similarly, Chapter 7 gives a detailed account of non-natural disasters in GCC and UAE and analyses why non-natural disasters become more important issue in this region of the world.

Part 3 is devoted to present and discuss the roles and responsibilities of the disaster management institutions in Abu Dhabi. Chapter 8 lists the international organizations concerned about non-natural and anthropogenic hazards and identifies the international disaster mitigation agencies at work in Abu Dhabi, then discusses the roles, responsibilities and the legal instruments that govern them. Chapter 9 deals with the disaster administration and management system in GCC, UAE and Abu Dhabi. Chapter 10 specifically identifies the critical and non-critical players of Abu Dhabi involved in the governance of disaster management.

Part 4 is devoted to present the disaster management experiences in Abu Dhabi and the data analyses made. Chapter 11 “Analysis, Findings and Discussion” is devoted for presenting the various analyses made in the report, the findings from those analyses and the discussion concerning the analyses. Chapter 7 presents the ‘Conclusions’ from the various results of the analysis. The primary data for the research was obtained through interviews, survey questionnaire, checklist etc. Self-assessment questionnaires, Survey questionnaire, HFA Benchmark analysis checklist etc. were also devised. These data were analyzed using methods like “Content Analysis”, “SWOT Analysis”, “Gap Analysis” and “Risk Assessment Analysis’ and the findings are presented in Chapters 11, 12, 13 and 14 respectively.

A general introduction and general conclusion are also presented as part of the thesis for a quick understanding the research work done in this project.

***PART 1 - DISASTERS: A SOCIAL AND SCIENTIFIC ISSUE
AT THE WORLD LEVEL***

CHAPTER 1: INTRODUCTION TO DISASTERS; TYPES AND TRENDS

INTRODUCTION TO THE STUDY

1.1 Introduction to Disasters

1.1.1 Disasters; Types and Trends

The term "Disaster" has been defined variously in literature. One of the many definitions of disaster found in the literature says, "Disaster is a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources". The Free Dictionary defines disasters "an occurrence causing widespread destruction and distress; a catastrophe; a grave misfortune". For a layman, it simply translates into immeasurable amount of distress, grief, agony and loss.

There are different meanings of the term disaster. However, before narrowing down on the views of different researchers, authors and scholars, it is critical to have a preamble of the concept of disaster. Generally, the term disaster has been interpreted from technical, sociological, political and medicinal perspectives. Consequently, each of these disciplines has evolved as the pillars of understanding how both natural and man-made disasters are founded and experienced¹.

The conventional understanding of the term disaster is found among different linguistic settings such as Italian, French, Greek and Latin from the year 1297. For example, the French refer to it as "disastre" and the Italians refer to "disastro". In these two cases, the term disaster is invoked to mean "ill-starred", whereby the prefix "dis-" further means "away, without," and "astro" meaning "star planet." In Latin, the term emanates from the word "astrum" and in Greek it is from word "astron"². Earlier studies on the possible causes of disasters and calamities were based on the astrological studies to determine if any calamity would befall people or region in the interim period.

¹ Siriwardena, p. 251.

² E.G. NeSmith., Defining "Disaster" with Implications for Nursing Scholarship and Practice, *Disaster Management & Response*, 4(2), 2006; pp. 59-62.

Some of the most conspicuous political bodies are United Nations (UN), International Committee of Red Cross (ICRC), World Health Organization (WHO) and national NGOs. Each of these bodies has varied understanding of the term disaster. For example, the Center for Research on the Epidemiology of Disasters (CRED) refers to a disaster as “a situation or event, which overwhelms local capacity, necessitating a request to national or international level for external assistance: an unforeseen and often sudden event that causes great damage, destruction and human suffering.”³

1.1.2 Natural and Technological Disasters

Disasters are broadly classified into two types – natural disasters and technological (man-made) disasters. Natural disasters are broadly categorized as hydrological, climatological, meteorological, biological and geophysical disasters. Technological disasters fall broadly into three categories, namely, industrial accidents, transport accidents and miscellaneous accidents. The types of disasters and their sub-types are given below.

<i>NATURAL DISASTERS</i>		
1.	Hydrological	Flood, Landslide
2.	Climatological	Drought, Wildfire,
3.	Meteorological	Extreme temperature, Storm
4.	Biological	Epidemic and Insect infestation
5.	Geophysical	Earth quake, Avalanche, Volcanic activity
<i>TECHNOLOGICAL DISASTERS</i>		
1.	Industrial Accident	Fire, Explosion, Subsidence, Collapse, Chemical spill, Poisoning, Gas leak, Poisoning, Radiation etc.
2.	Transport Accident	Air, Water, Road, Rail
3.	Miscellaneous Accident	Fire, Explosion, Collapse

³ Siriwardena, op cit., p. 252

While technological disasters are predictable to some extent and are mostly confined to particular industry location or segment, natural disasters are habitually unpredictable and have a capacity for large scale damage over communities and businesses. A detailed account of natural and man-made disasters is given in the Chapters 2 and 3.

1.1.3 Disaster Trend – Worldwide

A study of the Emergency Events Database (EM-DAT) managed by Centre for Research on the Epidemiology of Disasters (CRED) in Brussels indicated that the number of natural and man-made disasters was rising exponentially and this was a cause for concern. Data gathered working with the World Health Organization indicates that from 1900 to 2006, the sum of disasters rose by 76% globally. Additionally, the study indicated that loss of human life due to such disasters globally was 37,687, 619. Overall, some 5444 recent disasters account for 1,206, 688 lost lives and this trend is a major motivation for this study⁴.

The data gathered from the Centre for Research on the Epidemiology of Disasters (CRED) web site is presented below. Table 1 illustrates the number of all disasters, reported from 1900 to 2006⁵. Figures 1 and 2 depict the trend of natural and man-made disasters in graphical form for the period 1900 to 2015.

Table 1: Disaster Trend – All Disasters (From 1900 to 2006)

Period	Number of disasters
1900-1909	93
1910-1919	113
1920-1929	121
1930-1939	184
1940-1949	250
1950-1959	361
1960-1969	673
1970-1979	1176
1980-1989	2794
1990-1999	4737
2000-2006	5444

⁴ Siriwardena, op. cit., p. 250.

⁵ CRED, “The OFDA/CRED international disasters database”, December, 2006, Retrieved January 15, 2015, www.cred.be/emdat/disdat.htm.

Source: EM-DAT: The Office of Foreign Disaster Assistance OFDA/CRED International Disaster Database

Figure 1: Disaster Trend - Natural Disasters - 1900 to 2015

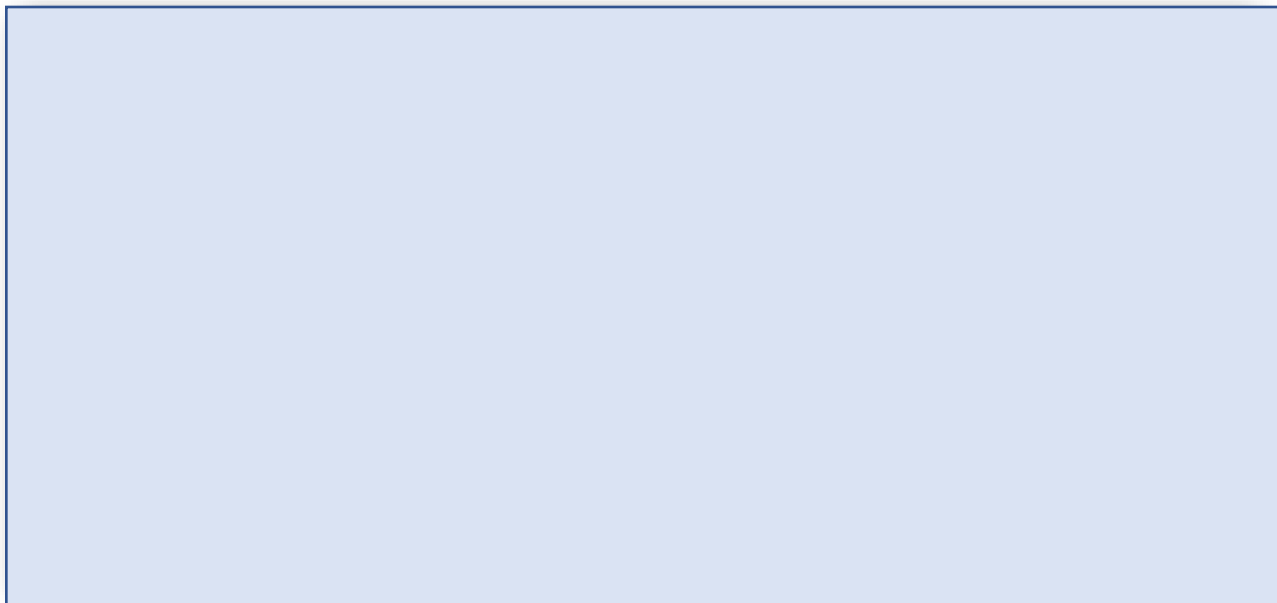
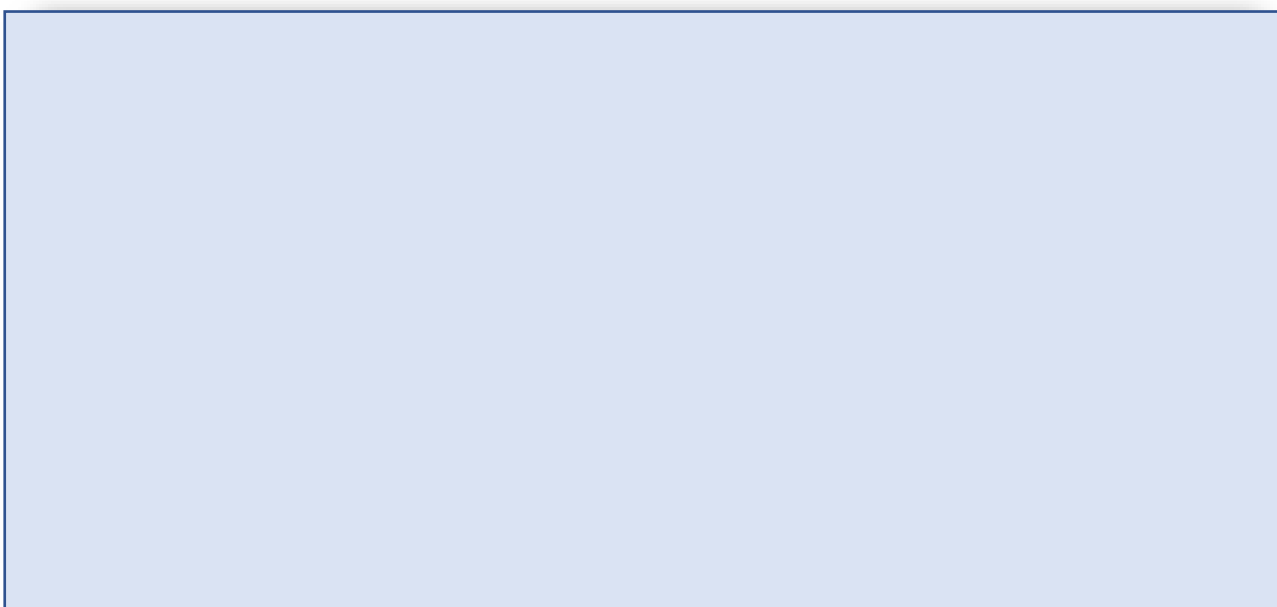


Figure 2: Disaster Trend - Technological Disasters - 1900 to 2015

As illustrated in the figure below, Data from the OFDA/CRED International Disaster Database for 1900-2004 show a steady rise in the number of natural and man-made

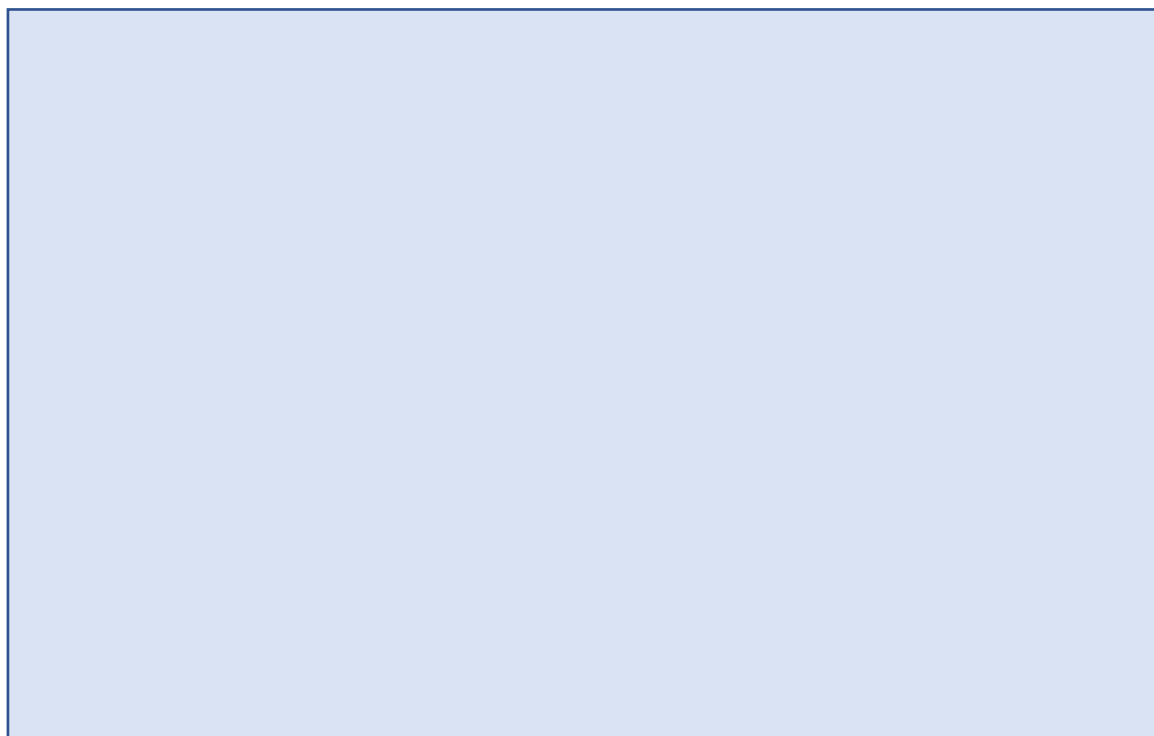


disasters⁶. The same figure also shows the trends in technical caused disasters especially from the industrial chemical spillages and hydrocarbon truck accidents. Other than the financial costs impacted by the natural disasters, the economic and social ramifications are equally devastating. Research has identified the most common man-made disasters as composed of global, regional credit crunches, national financial crises, civil wars among others as also shown in the figure⁷.

Whereas the man-made disasters like civil wars show active trends in the figure, it is worthy to note that the UAE, which is core geographical focus in this study, has been stable over the period of that study.

Figure 3: Frequency of Natural and Man-Made Disasters - 1900 to 2010

Source: Sawada, et al., 2011, p. 18.



The trends for the major world wars are somewhat constant as a lot of peace initiative has been prevailing over time. The figure further illustrates that economic crises have

⁶ Y. Sawada, R. Bhattacharyay & T. Kotera, *Aggregate Impact of Natural and Man-Made Disasters: A Quantitative Comparison*. University of Tokyo and RIETI. RIETI Discussion Paper Series 11-E-023. 2011. Retrieved <http://www.rieti.go.jp/jp/publications/dp/11e023.pdf>

⁷ Sawada, Bhattacharyay & Kotera, *ibid*, p. 2.

been volatile from 1980 towards 2000 with speculations they were spillover effects from the Asian and the Latin America financial crises⁸.

According to Barro⁹, even though the natural and non-natural disasters are mutually independent events, their impact to humanity and businesses has some similarities. For example, economic burden and loss of lives is a common running theme. Citing the case of earthquake in Japan in 1923, the impact felt in the nation for very many years to come including the reduction of the national GDP. The disaster posed by this earthquake is therefore a classical example of an external economic shock that depressed productivity for a while. In the end Japan was in serious debt from 1923 to 1924 and even the balance of trade was not in the nations favor¹⁰.

Whereas some studies found no correlation between natural and man-made disasters¹¹, other was quite the contrary. Data from 41 nations in the African continent from 1981 to 1999 has established that civil strife slows down economic growth irrespective of the national wealth, state of democracy and ethnic cohesion¹². This study had limitations because it did not cover other forms of conflict such as natural disaster, ethnic wars and general slowed down economies.

Some natural disasters occur because its causal hazards or environmental vulnerability or systems failed to live up to its prevention. Whereas some natural disasters cause immense social ramification, other negative consequences can be limited. Other scholars view disaster as imbalance between natural resources and man-made needs, daily tasks and events. However, the impact of natural or man-made disasters has tended to be erratic in economic spheres, political lobbying, psychological devastations, social order and ecological degradations.

The following table further defines natural and man-made disasters by type and periodicity.

⁸ Ibid, p. 2.

⁹ Barro, p. 243,

¹⁰ M, Obstfeld & K, Rogoff, *Foundations of International Economics*, The MIT Press, Cambridge, Massachusetts, 1996, p. 97.

¹¹ Sawada, Bhattacharyay & Kotera, *ibid*, p. 12

¹² E, Miguel, S. Satyanath and E. Sergenti, 'Economic Shocks and Civil Conflict: An Instrumental Variable Approach,' *Journal of Political Economy*, 112(4), 2004; pp.725-752.

Table 2: Definition of Disasters by Type

Sudden Natural	Long-term Natural	Sudden Human-made	Long-term Human-made
Avalanche			
Cold wave			
Earthquake		Structural collapse	
Aftershock		Building collapse	
Floods		Mine collapse or cave-in	
Flash flood		Air disaster	
Dam collapse		Land disaster	
Volcanic eruption		Sea disaster	
Glowing Avalanche		Industrial/technological accident	
Heat wave	Epidemics	Explosions	National (civil strife, civil war)
High wind Cyclone	Drought	Chemical explosions	International (war-like encounters)
Storm	Desertification	Nuclear explosions or thermonuclear explosions	Displaced population
Hail	Famine	Mine explosions	Displaced persons
Sand storm	Food shortage or crop failure	Pollution	Refugees
Storm surges		Acid rain	
Thunder storm		Chemical pollution	
Tropical storm		Atmosphere pollution	
Tornado		Chlorofluoro-carbons (CFCs)	
Insect infestation		Oil pollution	
Landslide		Fires	
Earth flow		Forest/grassland fire	
Power shortage			
Tsunami and tidal wave			

Source: International Federation of Red Cross and Red Crescent Societies (IFRCRCS)

(1993)

1.1.4 Various Interpretations of Natural and Technological (Man-Made)

Disasters

- The Technical Interpretations Behind Natural and Non-Natural Disaster

As indicated in the previous section the first reason of natural or non-natural disaster can be viewed from technical aspects. According to the Oxford Dictionary of English and from a technical perspective, a disaster is “a sudden event, such as an accident or natural catastrophe that causes great damage or loss of life.” The same dictionary describes a catastrophe as “an event causing great and often sudden damage or suffering.” Putting all these into technical perspective, a disaster is “a sudden, unplanned event with a significant scope of impact involving many people if not an entire community and is based on the scope of the event, number of lives impacted and the devastation of property, the disruption of critical business activities for some predetermined period of time.”

There are some expert contributions to ease the technical understanding of concept of natural and un-natural disasters. As stated by Hodgkison and Stewart, disasters tend to manifest are threat to normal business activities and require urgent interventions because their consequences are uncertain. Additionally, disasters have negative impact on people and their organizations mandated to react to every occurrence. Consequently, disasters are broadly classified as emergencies depending on their “severity and magnitude resulting deaths, injuries, illness and property damage” which cannot be mitigated effectively based on the available resources and protocol.

- The political interpretations of natural and non-natural disasters

Across the world, there are numerous political engagements around natural and un-natural disasters. Indeed, when natural and non-natural disasters occur, there are always political lobbying for assistance from the government, community business owners and other sources that are helpful. In most cases, the political intervention is in form of humanitarian relief to affected families, businesses and region. The role of political lobbying and action is never for granted in a democracy because the citizens can use that as a gauge for comparing the sensitivity of the government of the day.

Timely political interpretation and intervention into disaster events is known to save lives and minimize the negative effects to society and businesses before issues escalate.

This explains why in many polarized nations, when disaster strikes, the opposing sides often come together to mobilize the needed relief or humanitarian aid. Additionally, timely political intervention can save the national infrastructure from dilapidation and further save the country money to be diverted for reconstruction purposes.

In any disaster, the political dispensation is mandated with securing the local infrastructure and the assets of the business communities. Nevertheless, in some instances, this political system has failed dismally leading to wanton destruction of property and loss of lives. Some governments decry lack of funds or appropriate resources to respond to some types of disasters. Generally, most governments have a disaster response committee, composed of multi-agency experts and professionals with a central command center. In order for such committees to be efficient, the political leadership must allocate some funds annually to respond to any disasters, whether natural or non-natural.

Some nations have a working relationship between the political leadership and private business owners to assist whenever disasters occur, even though the success of such partnership is never always successful. The causes of failures during disaster mitigation include suspicion between the private and political heads or questions about how selections of stakeholders are addressed. If the political heads can reach consensus, then the disaster recovery process can speed up. Another opportunity for political interpretation of disaster is the financial implication. Therefore, it is upon the political leadership to debate on the financial risks in case some interventions are forthcoming since the disaster recovery process is abrupt and can be costly. Whatever is the position, political lobbying can help raise funds aside from relying on the government budgets.

- The medicinal interpretations of natural and non-natural disasters

In medical perspectives, a disaster can occur because of natural and non-natural events that overwhelm human capacity and imposes financial burden to the people, normal governance routines. A disaster also disrupts communication and logistical infrastructures, pollute water, air, land and render food production, sanitation and health access a failure. The outcome of a disaster is massive chaos whose magnitude, frequency and coordination to respond are not guaranteed.

Frederick C. Curry, who stated that the term means “a situation resulting from an environmental phenomenon or armed conflict that produces stress, personal injury, physical damage, economic disruption or great magnitude”, postulated the finer medical perspective of disaster. A related definition of the term disaster with medical connotation was by Perez and Thompson, who stated that the term means, “the occurrence of widespread severe damage, injury, or loss of life or property, with which the community cannot cope and during which the affected society undergoes severe disruption.” These two definitions extend to psychological and physical ramifications and injuries, which require prolonged period before the affected persons recover. However, various researchers differ on the understanding of duration of psychological effects because some can be short term but cause insomnia to the person. Other can manifest as loss of appetite, change in temperament and anxiety disorders to the society.

- Sociological, cultural and religious interpretations of natural and non-natural disasters

According to some classical views, a disaster is defined as a phenomenon that does not align with social interpretation. Consequently, Fritz gave various views of how sociologists understand the term disaster. First, disasters occur in specific places and time. Second, disasters have definite impact on the society. Third, disasters have social units. Fourth, the social units dictate how people should respond to disasters or readjust to their effects. The effects of disasters in social realm extend to physical demolitions and destructions that face the society and alter their way of life at least for a while. A person, a community, defines the social units or a nation that are vulnerable to the impacts of a disaster in different proportions. Therefore, disasters can be witnesses over period, location, damages and other forms of negative effects. The qualification and quantification of disasters in the social context is what defines how much response the society requires to bring back their normal lives.

Four aspects of disaster have the greatest impact on social being. These are agents of disaster, the physical outcomes, the consequences, the process of assessing the impact and the social ramifications. Therefore, Torrey defined disaster from a social perspective as the aggregate factors that cause visible or tangible damages to the society in

proportions that many functions and infrastructure fail to serve the society at their maximum potential unless they are repaired and irrespective of whether deaths occurred.

1.1.5 Globalization, Global Warming and Economic Consequences of Disaster

The concept of globalization is apparent from the business sustainability and continuity strategies adopted to take care of interest whenever disaster strikes. This is because the impact of disaster in one country affects another. Consequently, it is common to find investors establishing business continuity planning (BCP) that will ensure if their operations are affected in one nation or region, the other can support the supply chain and ensure customers or clients are retained. In support of the business strategy of globalization to manage disaster risks, John Donne stated, “No Company is an island, entire to itself; every company is a piece of the continent, a part of the main”.

Businesses that adopt the globalization strategy for disaster risk management are also benefiting from international value addition and branding. Other than supporting the global communities where the businesses are located exactly by creation of employment, there is better spread of risks. This does not mean that the globalization concept offers total cushion from all social disasters, however, there is fair level of risk management compared to businesses, which are localized with no branches.

Globalization has offered businesses opportunity to think beyond the local infrastructure, assets and labor, which could be vulnerable to impact of natural and man-made disasters. Additionally, when natural or man-made disasters affect the local community who are the key market population, globalization ensures the products to wider territories. This implies that globalization has better business sustainability prospects than localization in case disaster strikes.

Weather data in the last two decades indicates that the natural disaster events have increased due to global warming. However, even as businesses seek to benefit from the fast mover advantages of globalization, they are not very free from the risks and vulgarities associated with rapid change of weather. The close connection between local businesses has further heightened their probability of exposing to the natural disasters. This is the case as many businesses are slow at implementing pre-disaster risk assessments.

Climate conservation practices in one country have a direct effect on another from a globalization perspective. Due to the current changes in climatic conditions, the world is becoming more vulnerable to disasters because the weather patterns are affected with a spill over to businesses. Some of the unpredictable disasters connected with the changing climatic conditions are flash floods, prolonged drought and occasionally tempest. Global warming has altered the weather patterns of various regions, aside from causing serious disasters like flooding and changes in the water table. The cumulative problems arising from global warming are due to inconsistencies among nations and their leaders in committing to ways of reducing the impact. Whereas some nations take lead to minimize the effects of global warming, others are overlooking the same and this exposes them to the unpredictable risks.

Back in July 2005, India and specifically in the Mumbai regions experienced as much rain for a whole year within 24 hours. There was no doubt that this was the biggest torrent to be experienced in decades in India. Global warming was blamed for the rapid change in weather patterns that affected India and other places around the world. The heavy rains swept down houses and other physical structures and the small and big roads were flooded some up to 3 meters level. More than 1,000 people lost their lives while another 20,000,000 were completely disorientated by the flooding disaster.

All the small to big business around Mumbai shut down, as people were more concerned about their survival as a matter of priority. Some of the most affected businesses were commercial, rental, shops and industry related. It took Mumbai weeks to get back to the buzzing business activities and the economy of India slowed down since Mumbai is a critical commercial hub with numerous online trading coordinated from here. According to the Munich Re, the Mumbai floods disaster was estimated to have caused losses worth \$770 million.

In the recent decades, economic globalization has been stepped up and this has exposed many businesses to disasters far away from the country of registration. Consequently, some businesses faced with social or economic disasters in one nation or region spill over the same to a faraway location. Citing the global warming consequence of Tsunami sweeping across vast Asian regions in 2005, it was notable that the negative

effects were felt as far as Sweden. Additionally, China and Japan had serious rising water levels that escalated all the way to the Panama Canal.

1.1.6 The Impact of Disaster to People

Various researchers have been giving conflicting information about the economic value of disasters triggered or associated with global warming. Even though these studies concur that, the natural disasters associated with global warming are on the increases, the statistics range in the billions of dollars. For example, a published annual report by the Munich Re estimated that the total losses from global warming disasters in 2005 alone surpassed the US\$210 billion mark.

In terms of disaster complexes, there are factors that affect or magnify the impacts of disaster. The discussion of these factors is best approached by serializing types of disaster hazards. First, on famine and drought related hazards, the more dense the population, the higher the number of people affected and possible the fatalities. Ordinarily, famine is caused by prolonged periods of rain failure to support crops and hailstone destroying crops and sometimes flooding that sweeps across vast farming lands. Similarly, infertile land and poor balance of food resources in a nation or region can also lead to famine.

A study published by the World Disaster Reports (2001) by the International Federation of Red Cross and Red Crescent looked at the impact of vulnerability or impact of disasters to people. This study considered how low, medium and high levels of Human Development Index (HDI) as affected by disasters as illustrated in the table below. The study reveals that the lower the HDI, the higher the deaths and the fewer the loss of assets per disaster and the reverse is also true as shown in the table below.

Table 3: Human Development Index (HDI) vs. Disaster Impact

	Deaths per disaster	Loss per disaster (\$ millions)
Low HDI	1,052	79
Medium HDI	145	209
High HDI	23	636
<i>Source: based on IFRC (2001a: 162, 164)</i>		

A former UN Secretary General Kofi Anan stated in 1999, "...poverty and population pressure force growing numbers of poor people to live in harm's way—on flood plains, in earthquake-prone zones and on unstable hillsides." A combined report by the INCAE (Instituto Centroamericano de Administración de Empresas) and Harvard University's Institute for International Development stated that, "the conditions of poverty in Central America are the fundamental cause of their vulnerability in the face of natural disasters." In Honduras following the Hurricane Mitch, "there is no doubt that the greatest number of victims emerged from the most humble communities such as those of the Municipality of Choloma, La Lima and El Progreso, its towns and banana fields"

1.1.7 The Impact of Disaster over Business Continuity and Sustainability

Various business sectors are often affected by disasters. However, one sector that normally takes leading negative impact on land is the building and construction industry. Essentially, the construction sector comprises building of houses, roads, bridges and other physical planning amenities. During catastrophic events, this industry and others suffer immense damages and could paralyze transport activities. Whereas some of the disasters that befall the construction business are largely natural from typhoons and hurricanes, others are caused by man-made errors such as use of substandard materials. The following table illustrates example of industrial disasters.

Table 4: Past Industrial Disasters

Chemical involved	Consequences	Place and date	
	Death	Injuries	
Methane	136	77	Cleveland, Ohio, United States, 1944
Dimethyl ether	245	3,800	Ludwigshafen, Federal Republic of Germany, 1948
Kerosene	32	16	Bitburg, Federal Republic of Germany, 1948
Phosgene	10	-	Poza Rica, Mexico, 1950
Liquefied petroleum gas	18	90	Ferzyn, France, 1966
Isobutane	7	13	Lake Charles, Louisiana, United States, 1967
Oil slops	2	85	Pernis, Netherlands, 1968
Propylene	-	230	East Saint Louis, Illinois, United States, 1972
Propane	7	152	Decatur, Illinois, United States, 1974
Cyclohexane	28	89	Flixborough, United Kingdom, 1974
Propylene	14	107	Beek, Netherlands, 1975
Liquefied natural gas	40	-	Staten Island, New York, United States, 1973
Methane	52	-	Santa Cruz, Mexico, 1978
Liquefied petroleum gas	650	2,500	Mexico City, Mexico, 1985
Chlorine	7	-	Wilsum, Federal Republic of Germany, 1952
Dioxin/TCDD	-	193	Seveso, Italy, 1976
Ammonia	30	25	Cartagena, Colombia, 1977
Sulphur dioxide	-	100	Baltimore, Maryland, United States, 1978
Hydrogen sulphide	8	29	Chicago, Illinois, United States, 1978
Methyl isocyanate	2,500	200,000	Bhopal, India, 1984

Source: Bertazzi, 1999, Online

Estimating the exact damage, that disaster cause to businesses is a very difficult task. However, taking the example of Hurricane Sandy, which swept through sections of the U.S. recently, authorities, estimated that about 120 people lost their lives. Additionally, property worth US\$80 billion was destroyed, yet the U.S. government had a provision of about US\$9.7 billion earmarked for disaster mitigation and recovery efforts. After serious lobbying and deliberations, the U.S. Congress released another US\$51 billion albeit

several months after the Hurricane Sandy had calmed down. In terms of business support, such a belated financial support does not help some investors come back to operations as fast as they would hope.

Lately, there has been increasing number of natural disasters such as storms, heat waves, heavy rains and other forms, yet most governments seem to be found unaware every time. It is puzzling how governments are unable to use one disaster as a potential case study for another in future. For example, the experiences and lessons of Hurricane Katrina should have been extended to Hurricane Sandy. In terms of businesses sustainability, there were numerous reports that the global warming was causing rise in sea levels, possible by over three feet in the last century alone. Hence, if any business investor was interested in the East Coast, this factor should have been deliberated as a major risk. In that case, such a business would require extra budgetary allocations to cater for such disasters.

Prior planning and evaluation of the sites to locate businesses must be comprehensive if businesses want to survive such disastrous events. A business risk analysis is paramount to check if the business is sustainable against the possibilities of tornadoes, hurricanes, droughts, fires, floods and other types of hazards. Each of these issues has some relationship with “global warming, energy and fuel costs, resource scarcity, water shortages, population issues, ecosystem issues, and deforestation.” Therefore, all business leaders must be able to ponder over the cyclical relationship of these factors and on establishing the root causes, decide on the best way to reduce their impact or occurrence as was proposed by NCEMA below.

Figure 4: NCEMA Business Continuity Model

During such business risk analysis, it is possible that the investors around the East Coast concluded that Hurricanes are the least likely disasters that could affect their entities, by considering that the last major events were nearly half a century away. Nevertheless, additional sustainability tests would have indicated that the sea water levels have been rising in the last century and the wind speeds have more than doubled. Moreover, the congestion of the existing infrastructure would have indicated the potential damage if such a disaster occurs. The extra mile in business risk and sustainability checks would have pointed to the likelihood that the next major disaster is a hurricane whereby business recovery would be very tricky. Focused businesses having such knowledge will

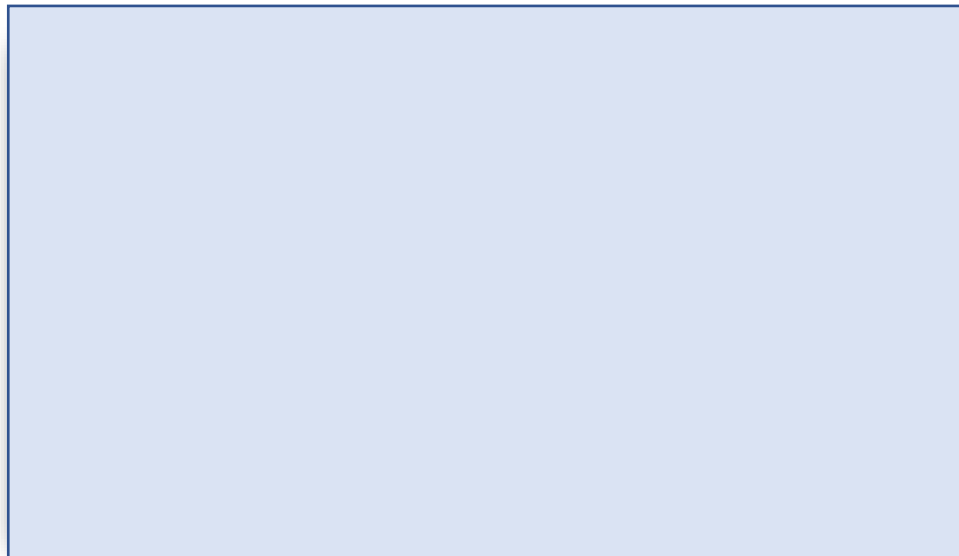
normally expand their business supply chain to cover other areas beyond the zone of hurricanes or big storms. The fact that business insurance and government agencies often delay to reimburse investors does not make things easier.

The UN's ISDR and the business understanding of the term disaster concur that the period before and after risk, management is crucial. Yet many businesses do not seem to give enough attention to the pre-disaster period. The ISDR and business entity holders' intention is to put up a multiagency or skilled group of personnel to scan and mitigate any forthcoming risks. If such a common approach is adopted, even if a disaster occurs, the damage is likely to be reduced in cost of reconstruction. Moreover, such businesses are likely to get back to operations within the shortest time.

1.1.8 Business Disaster Risk Management

Business disaster risk management entails the entities ability to evaluate and control any man-made, technological or natural disaster risks that could encroach and affect their daily operation, devalue assets and diminish their earnings as shown below.

Figure 5: Disaster Risk Management in Businesses



Source: Vorhies, 2017, p. 5.

Many businesses are often ready to participate in disaster relief processes. Very few cases are highlighted on how the same businesses prepared for the disaster before it

happened. Once disaster happened, many businesses always seem willing to spend some emergency funds or resources to help in the relief efforts. Whereas this gesture enables the affected to come back to operations within the shortest time, it also helps to elevate their public profile under the Corporate Social Responsibility (CSR).

The bigger challenge facing many businesses as far as disasters are concerned is their capacity to carry out risk management and recovery efforts. Whereas many private businesses tend to downplay disasters in their entities to protect their clientele base, it would help if some level of transparency exists to show the market their resilience. A common disaster management strategy preferred by many businesses is elimination, intervention and avoidance of the risk causal factors.

All businesses are made up of personnel, products and processes, interconnected in a triangular manner. Therefore, when disaster strikes, one or more of the triangular bonds is broken and the negative effects trigger immediately. The people dimension has both internal and external stakeholders with stake that faces loss or benefit when disaster strikes. Even though the external people to a business entity have lesser contractual obligations, they however hold key to success of the system especially as customers or clients. Some of the business external people are the supplies, customers, banking institutions, credit guarantors, investors, lobby groups and the public.

According to Turner, bona fide business stakeholders are referred to “all people or groups whose lives and environment are affected by the project, but who receive no direct benefit from it”. Walker extended the definition of business stakeholders who are vulnerable to the effects of disaster as buyers of products and services from the local community. However, in terms of business sustainability, the term Corporate Social Responsibility (CSR) is often invoked to define the wider community that compose the business stakeholders and who are vulnerable to the negative effects of disaster when it strikes. Jones & Comfort defined the term CSR as “a concept whereby companies integrate social and environmental concerns in the business operation and in their interactions with their stakeholders on a voluntary basis”. This definition covers wider legal implications that obligate businesses to comply on social structures, environmental sustainability and economic targets even is a disaster was to strike.

The construction business entails setting up new structures or refurbishing the existing ones. Furthermore, the construction business has three major divisions. These are contracting works involved in building commercial and domestic structures; heavy and civil engineering composed of roads, bridges, drainages, tunnels and other capital intensive tasks; and the specialty tasks composed of smaller jobs like plumbing, electrical engineering among others.

It is important for the respective business stakeholders to ensure their entities observe health and safety regulations so that they minimize impact of disasters when they strike. Such a framework will address all the environmental issues, improve the relationship among the stakeholders, improve the supply chain performance and establish crucial networks. Additionally, business stakeholders should endeavor to invest internationally so that when disaster strikes, the risk are spread across borders.

Some of the common effects of disaster include displacement human dwellings, social stresses and slowdown in economy as resources are diverted from growth to recovery objectives. For that matter, disasters tend to disturb the normal businesses operations and it is upon the respective entities to ensure there are structures to respond in time. Some of the common structures that businesses can set up proactively are health and safety systems, establishing environmental friendly area of work, producing acceptable quality products and review of existing or new policies to accommodate CSR.

Many businesses often lack a disaster management policy, hence, the impact to their businesses drags on longer than expected. Additionally, many businesses tend to have disaster management policy that covers non-natural disasters while ignoring the natural situation on the pretext that the latter is unpredictable. A typical disaster management policy that any business should have must include the organizations preparedness for any events, their mitigation strategies, the risk minimization plan, recovery from the aftermath, communication of the events to attract appropriate response and rebuilding of the damages assets. This implies that the business must have an active planning committee or focus group; an action and organizing group; and designated leaders to deal with any disasters without undue delays. The following chart is a representation of business risk evaluation.

Figure 6: Business Risk Evaluation and Compliance



Source: NCEMA, 2007, p. 87

Other common man-made disaster that affects businesses is the global financial crisis ostensibly due to mismanagement at key financial institutions or sectors. The seasonal global economic crises tend to cause broadcasted and untold suffering to the populations and many languish in poverty, as was the case during the Great Depression in the 1930s. These crises affect the respective national economic prosperity. For this reason the global financial crisis are perfect examples of man-made disasters due to the negative effects on human lives. Numerous studies have been accomplished on the triggers and effects of natural and non-natural disasters. The process of determining the actual social cost of these disasters is rather complicated and inconclusive because different researchers vary in approaches for specific disasters.

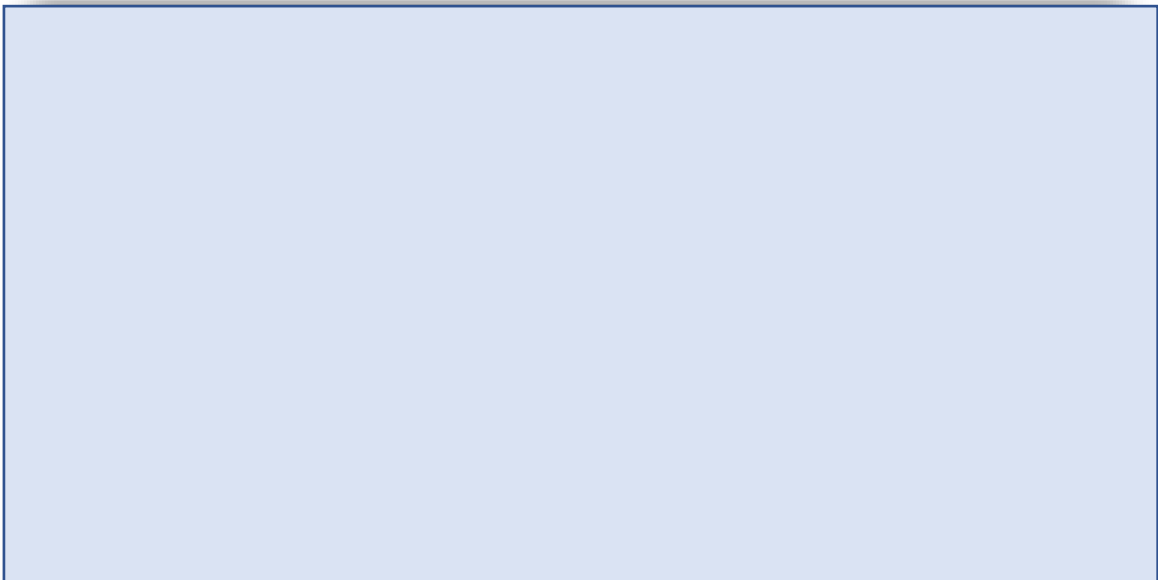
The increasing global population and density at specific regions in the world makes impact of disasters extremely devastating. The Secretary General of the OECD Angel Gurria, was quoted in September 2006,

“While technological innovation, globalization, the growing interdependence of critical networks, and the high concentration of populations and assets all have their well-

recognized positive effects, they also dramatically increase vulnerabilities to natural, technological and terrorism hazard.”

In the current decade, there are numerous vulnerable businesses, which have global connectivity such that when disaster strikes in one nation, the ripple effects trickle down to another region. The common practice of some manufacturing and service business to outsource whether material or value chain to reap economies of scale and scope is becoming more exposed with some of the regular occurring disasters. This shows how the world is interconnected. As ease of doing, business in some regions and nations is becoming difficult, some enterprises have shifted to areas perceived as very favorable only to be struck by some disasters. The following figure illustrates impacts of disasters on businesses.

Figure 7: Impact of Disasters on Businesses



Source: Vorhies, 2007, p. 9.

Considering the frequency of disasters that befall many businesses, it is more likely that the entities vulnerability rather than the global interconnectedness that determines the impact and speed of recovery. Additionally, businesses that are more aggressive at off shoring activities are more resilient because their spread their risks including costs of operations, low wage market and loyal clientele base. These fast mover advantages explain why businesses are coupling economies of scale with disaster risk management.

The strategy of businesses off shoring to manage their disaster risks is paying off and entities are able to produce locally and market internationally and the revisers is also true. However, such businesses entities also face vulgarities like harsh weather in the West and East, seismic activities such as earthquakes in the Far East nations, frequent flooding in various Asian nations and other related natural disasters. Even if respective business owners find it lucrative to invest in regions previously confirmed as most vulnerable to the natural and man-made disasters, it is imperative to the stakeholders to ensure the assets are cushioned from these disasters. The following table illustrates how different business sectors engage disaster risk reduction:

Table 5: Business Disaster Risk Reduction Strategy

Industry	Disaster-related Competencies
Engineering/Construction	Design and build disaster resistant buildings and infrastructure projects
Energy/Utilities	Design and deliver disaster resilient energy, water and sanitation services
Food, Beverage & Agribusiness	Implement disaster resilient agricultural production and processing systems
Health	Ensure adequate supply of health services and medicines in case of disasters
Information Technology	Design and maintain global, national and local disaster information systems
Media & Entertainment	Build public awareness about the importance of disaster risk reduction
Mining & Metals	Ensure mines and mineral processing plants are disaster resistant
Professional Services	Advise on disaster risk reduction strategies and action plans; advise on multi-stakeholder processes for disaster risk reduction
Financial Services/Insurance	Develop disaster risk reduction insurance products; incorporate disaster risk management into due diligence processes
Retail & Consumer	Ensure supply chains are disaster resilient and build public awareness
Telecommunications	Implement disaster resilient communication systems; design and network disaster monitoring capacities
Logistics & Transport	Develop and implement disaster resistant transportation networks and systems
Aviation, Travel & Tourism	Design disaster resilient travel systems and tourism packages

Source: Vorhies, 2007, p. 21-22.

Disasters disrupt business operations including the social labor availability in areas like Asia. If these same businesses have owners or shareholders across borders, then the impact can spread as much. The priority of most businesses is to protect their wealth and assets for sustainability and growth. Additionally, businesses are concerned about the local infrastructure that enables them complete supply chain, find low operational costs, and easily connect with their clients or buyers logistically.

1.2- Introduction to the Study

1.2.1 Aims and Objectives

This study has two broad aims. First, is the assessment of the capabilities of Abu Dhabi business stakeholders to carry out natural and non-natural risk assessment that helps manage the associated hazards and recommends ways where specific impacts can be reduced including their future likelihood of recurrence. The second, is to articulate the key issues that affect Abu Dhabi government preparedness for natural and non-natural disasters from planning to execution. In order to address the above study aims, the following are the specific objectives:

1. To establish the Abu Dhabi government's structures, responsibilities and procedures for managing disasters and reducing their associated risks.
2. To assess the Abu Dhabi people's awareness and vulnerability of Abu Dhabi to different types of natural and non-natural risks.
3. To determine the Abu Dhabi businesses community's perceptions of disasters and articulate ways of sustaining continuity in collaboration with the government support in the wake of natural and non-natural disasters.

1.2.2 Research Context

Over the decades, the world has forced the UAE to make some radical changes from risk assessment and disaster conventions and ratifications. However, most of these positions are dynamic and the UAE has to cope with the rate of changes. The UAE has a wider mandate of understanding the sociological impact of disasters to the country's survival and undertake efforts that will enhance balance between nature and events as

they occur. The starting point for the UAE is to have clarity on the status quo that the nation carries along from Abu Dhabi, redefining the social order among the GCC, arriving consensus and professional integration on controversial issues with the rest of international communities, achieving environmental cohesion and conservation solidarity and role play with the world. This study aims at increasing knowledge¹³ on the achievements of UAE and how current and future sociologists will integrate human awareness on issues that have not been closed from 2005 onwards. The inferences from this study are therefore, delimited to Abu Dhabi, the UAE, GCC, Arab World and International Society and Worldwide.

Furthermore, this study is important because it reviews the distinction between natural and non-natural disasters which seem to narrow every decade. Specifically, with regard to the business community such as the construction industry, this study is very timely because the UAE has lately faced some geological hazards, climatic and environmental catastrophes, biological and man-made crisis, industrial and infrastructural disasters. Each of these events had some qualified and quantified economic and financial costs aside from their disruption of the normal human lives and functions. Whereas some disasters in the UAE are irreparable, the diversion of human lives and functions is an underlying concern because the risk could have been underestimated from the beginning. However, if the UAE government and the NGOs take a proactive role in averting especially the non-natural disasters, the physical costs and conservation of human lives are must forward looking.

The finer purpose of this study is to evaluate how the Abu Dhabi business community identifies potential disasters, prevents their reoccurrence, mitigates the live events, recovers the society and assets and triggers the reconstruction efforts. Generally, different views and definition of the term disaster exist because the UAE has a diverse view in some instances from the rest of the world. The justification for the UAE having a different view on the understanding of the term disaster arises from their environmental location within the GCC, the social position among the Arab World, the environmental

¹³ P.R. F, Trim, Disaster management and the role of the intelligence and security services, *Disaster Prevention and Management*, 12, 2003; pp. 6-15.

exposures from the international society, and their cultures, values and attitudes compared to the rest of the world.

1.2.3 Research Methodology

The methodology adopted for the research was the exploratory approach. Historical data available in the print and web literature on the natural and non-natural disasters were used in the research. The primary data for the research was obtained through interviews, survey questionnaire, checklist etc. Self-assessment questionnaires, Survey questionnaire, HFA Benchmark analysis checklist etc. were developed for this purpose. Analysis of these data using analysis methods like “Content Analysis”, “SWOT Analysis”, “Gap Analysis” and “Risk Assessment Analysis” was resorted to in arriving at the findings and conclusions.

1.2.4 Limitations of the Study

There are some grey areas as far as the term disaster and related terms are concerned. First is the difference between the term disaster and hazard. Whereas some authors tend to use this term interchangeably, it is regrettable that it could raise significant confusion¹⁴. According to the Oxford Dictionary, a “hazard is a risk or a danger”¹⁵. Other scholars like Shook¹⁶ define a disaster “a product of hazard and vulnerability”, which threatens lives, damages physical property, and disrupts the environment. By this definition, a hazard can magnify to a disaster. This view is widespread and was extended by Lakha and Moore¹⁷ to include any physical harm to man, their assets, surroundings or aggregate of all these. In summary, a hazard can pose danger to man and the community as a whole as activated by natural or non-natural events. Additionally, a hazard can escalate to a disaster, which later has greater effects on the society and even incapacitate their ability to deal with the consequences within the earlier phases¹⁸.

¹⁴ E. L., Quarantelli & R. R. Dynes, Response to social crisis and disaster, *Annual Review of Sociology*, 3, 1977, pp23-49.

¹⁵ *Oxford Dictionary of English*, Oxford University Press, 1999.

¹⁶ Shook, p. 80.

¹⁷ Siriwardena, p. 254

¹⁸ Ibid

The second grey area is the distinction between disaster and catastrophe. According to the Webster's dictionary, a catastrophe is "an event producing a subversion of the order or system of things; a final event, usually of a calamitous or disastrous nature; hence, a sudden calamity; great misfortune."¹⁹ Rodriguez, Trainor & Quarantelli in 2006 did extensive work to distinguish the differences between disaster and catastrophe. The first, the distinction is based on catastrophe as having the massive scale or impact to the society and its physical structures and as opposed to disaster, which has defined locality. The second distinction is that in a catastrophe, the local authority is incapacitated from accomplishing their work as opposed to a disaster where only sections of the official are affected for a while. The third distinction is that during a catastrophe, the required aid emanated from distant places as opposed to a disaster where there is convergence of aids from surrounding people or organizations. The fourth distinction is that during a catastrophe, majority of the society activities are simultaneously disrupted as opposed to a disaster where the interruptions occur in phases or systematically. The fifth distinction is that with a catastrophe, the international media get wind of the events and broadcast live as opposed to a disaster, which is an ongoing event that mostly the local media relay to the public. The sixth distinction²⁰ is that during a catastrophe, there is high-level government or NGO engagement because any delays can have dire consequences, as opposed to a disaster where medium to low-level officials are engaged together with the local community based organizations to resolve the issues.

The third major distinction worth mentioning in this study is between disaster and crisis. Generally, the word crisis is multifaceted and had different interpretations and meanings according to the context. In relation to risk management, the term crisis differs even further according to the culture affected, situation at hand, period and scholarly views. From an organizational perspective, a crisis is defined as "any event or condition that threatens the survival of the organization"²¹. According to the Oxford Dictionary, the term crisis means, "a time of danger or difficulty or it is a decisive moment or a turning

¹⁹ Webster Dictionary, 2005.

²⁰ H. Rodríguez., T. Trainor, & E. L. Quarantelli, "Rising to the Challenges of a Catastrophe: The Emergent and Prosocial Behavior following Hurricane Katrina." *The ANNALS of the American Academy of Political and Social Science* 604: 2006; pp. 82-101.

²¹ Kim & Lee, p. 163.

point”²². Furthermore, a crisis can encompass all natural and non-natural disasters and hazards. Not all crises are bad as some have merits while others have demerits²³.

It appears that there is no convergence agreement on the term disaster because different contributors have their own interest and disciplines that shape views²⁴. For example, the Bhopal gas leak in India was referred to as an “accident” in a report published by the Union Carbide, yet the scale of harm to humans was “disastrous”. The surrounding community also preferred to call the Bhopal event as a “tragedy”, “massacre” and some activists went further as “genocide”.²⁵ Putting together these diverse definitions of the term disaster is an arduous task because individuals and organizations sometimes overlap based on the social impact, financial obligations, physical harm, psychological damage, political lobbying, economic depressions and ecological devastations of the location, region or nation. It is clear that different disasters vary in their recovery speed and depth as some prevail for days while other for years. There are some impacts of disasters that are not easy to recoup. Hence, this study, at a later stage will review how some recurring disasters whether natural or non-natural can be prevented or mitigated to have the least negative effects²⁶.

1.2.5 Definitions

The WHO defines disaster as “any occurrence that causes damage, ecological disruption, loss of human life, deterioration of health and health services on a scale sufficient to warrant an extraordinary response from outside the affected community or area.” Consequently, by WHO standards, a disaster must be incapacitating and cause ecological disorder to a level where external assistance is warranted. Similarly, by WHO standards, a disaster normally has a geographical area affected at a specific time and hence its prevalence causes disruption of systems, structures and activities of social order to unanticipated proportions. Finally, by WHO standards²⁷, a disaster is characterized by

²² *Oxford Dictionary of English*, Oxford University Press, 1999.

²³ I. M. Shaluf, F. Ahmadun and A. M. Said, A review of disaster and crisis, *Disaster Prevention and Management*, 12, 2003; pp.24-32.

²⁴ Shaluf & Ahmadun, p. 25.

²⁵ *ibid*

²⁶ Shaluf & Ahmadun, *op cit.*, p 29

²⁷ World Health Organization, *Community emergency preparedness: a manual for managers and policy-makers*, Geneva. 1999.

events, which deviate from normal social order. Not all disaster emergencies cause loss of lives²⁸.

In 1990, a UN committee defined disaster as “a disruption of the human ecology that exceeds the capacity of the community to function normally”²⁹. Later, the UN’s Integrated Regional Information Networks provide a related definition of the term disaster as a “sudden, calamitous event that seriously disrupts the functioning of a community or society and causes human material, economic and environmental losses that exceed the community’s or society’s ability to cope using its own resources”. The same source attributes disasters to “hazards, vulnerability and inability to reduce the potential negative consequences of risk”³⁰.

According to the UN’s clarification, a disaster will be recorded in their database of International Strategy for Disaster Reduction (ISDR) if it meets at least one of the following guidelines that concur with the International Federation of Red Cross and Red Crescent Societies for oversight purposes³¹:

At least 10 persons die.

At least 100 people lives are affected.

When a nation or state declares a state of emergency.

When there is call for international intervention.

In the above criteria, the number of people who die can include “persons confirmed as dead or persons missing or presumed dead.” Additionally, the persons affected includes those “ requiring immediate assistance during a period of emergency, i.e. requiring basic survival needs such as food, water, shelter, sanitation and immediate medical assistance.” Therefore, it is common for the UN to combine the affected in different ways to achieve sum of all those perceived as “affected”³². The role of the UN’s ISDR is as follows:

“Aims at building disaster resilient communities by promoting increased awareness of the importance of disaster reduction as an integral component of sustainable

²⁸ I. Shaluf, & F. Ahmadun, “Disaster types in Malaysia: an overview”, *Disaster Prevention and Management*, 15 (2), 2006, pp.286-298.

²⁹ Bertazzi, A. *Disasters and Major Accidents: Disasters, Natural and Technological*, Chapter 39, 1999. Retrieved January 21, 2015, <http://www.ilocis.org/documents/chpt39e.htm>

³⁰ Siriwardena, op cit., p. 252

³¹ International Federation of Red Cross and Red Crescent Societies, *Disaster types*, 2006, Retrieved January 14, 2015, www.ifrc.org/what/disasters/types/

³² Siriwardena, op cit., p. 252

development, with the goal of reducing human, social, economic and environmental losses due to natural hazards and related technological and environmental disasters.”³³

The CRED defined a disaster “as unforeseen event that causes great damage, destruction and human suffering which overwhelms the local capacity, necessitating a national or international level assistance.”³⁴ CRED went further to classify disasters into three types, natural, technological and man-made. However, other researchers tend to combine the technological and man-made disasters into one form as non-natural³⁵.

CRED outlined the natural disaster causes broadly as hydro-metrological, geophysical and biological. CRED classified the technological disaster causes broadly into two categories; industrial incidences like chemical spillages, breakdown of the business facilities such as collapse of big buildings, fire incidences and radiation. The second category of technological disasters is transport and logistics oriented, whereby, roads, railway, air or water accidents occur with massive consequences. Finally, CRED classified the man-made disasters broadly as economic or civil strife causes³⁶.

Thus, researchers like Nesmith³⁷ stated that God, or circumstances beyond the control of man cause most disasters. This statement is supported by the numerous destructions of property, financial impact, environmental degradation, injury and loss of human lives. Supplementary impacts of disasters include water, land and air pollution, global warming and others. Additionally, disasters can alter the natural cycles such as rain patterns, frequency and intensity. For these reasons, it is always advisable for people, communities and nations to have disaster preparedness and mitigation structures. According to Shook, if disaster risk assessment and management accomplish before they actually occur; humans will be more prepared to deal with their actual occurrence and aftermath³⁸.

³³ UN International Strategy for Disaster Reduction. *Living with risk*. United Nations, Geneva, 429 pages, 2004.

³⁴ Center for Research on the Epidemiology of Disasters (2010), *CRED Emergency Events Database*, EM-DAT Database, Retrieved January 16, 2015, <http://www.emdat.be/>

³⁵ Perry, p. 65.

³⁶ CRED, 2010, Ibid.

³⁷ NeSmith., op cit., p. 251.

³⁸ G, Shook, An Assessment of Disaster Risk and its Management in Thailand, *Disasters*, 21(1), 1997; pp77-88.

CHAPTER 2: HISTORY OF NATURAL DISASTERS – A GLOBAL VIEW

2.1 The Historical Perspective

From the foregoing chapter, it is clear that natural disasters expose global populations to health risks, disruptions in weather patterns and unpredictable governance policies. Nevertheless, the natural disasters broadly categorized as hydrological, biological and geophysical can create one of the most unpredictable impact and outcome to communities and businesses. This is because natural disasters caused by flush floods, tornadoes, hurricanes and bushfires have capacity of damaging domestic and business assets and perhaps the whole household.

Natural disasters are very common across the world, with their effects felt by human beings, their social lives, businesses and industries. Ideally, human beings have been overcoming one natural disaster to the next. Natural disasters come in different proportions. Some have small impact depending on the people's preparedness while others have huge impact like what was witnessed in the U.S.A in recent times. As the natural disasters become bigger, they could make the historical ones look like a shadow, yet even one single death of man as an impact is not acceptable. Some natural disasters are believed to shape the lives of people after the recovery process.

In different occasions, natural disasters have shaped the speed and depth of civilization of people across the world. This is true because most natural disasters cause death of people and reshape their view of life. Such deaths create a break from the current state of civilization to the earlier ancestral days. Furthermore, as the disasters strike more frequently, the deaths curtail the global population whenever there are fatalities. Indeed, when the bubonic plague disaster also known as 'Black Plague' hit Europe during the 14th century, nearly half of the entire population perished.

Historians have documented that natural disasters are responsible for decimating entire civilization populations. Some of the most prominent civilization empires that were wiped out by natural disasters include the Mayans, the Norse, the Supe and the Ancient Egyptian Empires. Historians argue that if natural disasters did not occur, these empires would have lived longer. Among the disasters responsible for bringing down these great civilization empires are floods, tsunamis, famines, El Ninos, earthquakes among others. Historians argue that these civilization empires were so strong at their times than no

human man-made force would have changed their course as natural disaster accomplished.

Some recent international natural disasters warrant mentioning at this stage in brief. At the end of year 2004, a tsunami swept along vast Asian coastlines leaving a trail of destruction and over 300,000 deaths. The Cyclone of Nargis in Burma, killed 146, 000 people while many others went missing. During the Sichuan earthquake, about 69,000 people died while 375,000 were injured. Each of these events demonstrates the impact of modern natural disasters and is not expected to replicate in near future. However, these events of natural disaster cannot match some historical documented cases as illustrated in the table below.

Table 6: The Most Devastating Natural Disasters in World History

Event	Year	Fatality
Mediterranean earthquake (Egypt and Syria)	1201	1,100,000
Shaanzi earthquake (China)	1556	830,000
Calcutta typhoon (India)	1737	300,000
Caribbean hurricane (Martinique, St. Eustatius, Barbados)	1780	22,000
Tamboro volcano (Indonesia)	1815	80,000
Influenza epidemic (world)	1917	20,000,000
Yangtze River flood (China)	1931	3,000,000
Famine (Russia)	1932	5,000,000
Bangladesh cyclone (Bangladesh)	1970	300,000
Tangshan earthquake (China)	1976	655,000

Source: St. Louis University, 1997; NBC News, 2004.

In the last two decades alone, over 3 million people have succumbed to different type of natural disasters while another 1 billion were affected in some way. Analysts placed the 1991 cost of natural disasters at £17 billion and the mobilization of these recovery resources proved quite a challenge. Therefore, if different nations have a structured way of addressing natural disasters, the vulnerability will reduce significantly. Analysts are right to be concerned that natural disasters divert social energy from productive efforts to recovery work. Various nations are making progress on addressing the challenges posed by natural disaster by adopting the Hyogo Framework for Action 2005 – 2015.

2.2 Brief Account of Global Natural Disasters

CRED classified the natural disasters into three levels. First, the hydrological disasters and these are caused by flash floods, hurricanes and storms and prolonged droughts. Second, the geophysical disasters and these are caused by earthquakes and tectonic earth movements, tsunamis and volcanic explosions. Third are biological disasters and these outbreaks of diseases, epidemics and other forms of insect invasions such as locust and caterpillars destroying crop fields.³⁹

As mentioned earlier, various studies have endeavored to investigate the actual losses of natural disasters and this is an ongoing process. Additionally, studies estimate that for the last three decades alone, 2 million people have lost their lives due to about 7,000 international disasters. Another 5 billion people are affected by these disasters directly or indirectly. The study by Sawada⁴⁰ approximated the economic loss from 1980 to 2000 at over \$1 trillion even though other researchers placed it higher.

Recently, there was a plausible attempt to categorize the losses incurred from natural disasters as either direct or indirect⁴¹. Thus, direct losses refer to the immediate impact of the natural disaster whether physical or psychological. An example of analysis of direct cost of natural disaster from 1970 to 2002 was the cumulative deaths. On the other hand, the indirect losses refer to the invisible and intermediate effects of natural disaster typically demonstrated by productivity, economic growth, dilapidated infrastructure among others⁴².

Overall, the developed nations tend to have better cushion from direct effects of disasters as compared to the underdeveloped nations. This is because the underdeveloped nations have little or no insurance for their homes, health and other social support systems. Consequently, the underdeveloped nations facing disasters tend to have more deaths and diminished savings than their developed counterparts do. Additionally, the more developed nations tend to be more educated, are transparent, have stronger financial

³⁹ CRED, 2010.

⁴⁰ Sawada, Bhattacharyay & Kotera, p. 3.

⁴¹ S. Hallegate & V. Przyluski, 'The Economics of Natural Disasters', CESifo Forum 11, 2010; p. 14-24.

⁴² H. Toya & M. Skidmore, 'Economic Development and the Effects of Natural Disasters', *Economics Letters*, 94 (1), 2007; pp. 20-25.

management⁴³ discipline, and have more national credit reserved and lesser national government conflicts. This implies they would overcome natural disaster faster than their counterparts would.

Past studies on the indirect cost of natural disasters were accomplished by national events over long period. For example, a study from 1960 - 1990 based on the GDP erosion due to natural disasters revealed that such nations tend to have higher population growths, growing productivity rates and generally positive economic outlook. This finding is quite inspiring considering that natural disasters tend to divert resources from mainstream productivity to recovery efforts⁴⁴.

Different famines manifest in diverse ways, which could make their intervention process very complicated. For example, famine that is caused by civil war that prevents communities from venturing into farming activities can be very complicated to intervene unless the conflicting sides agree to cease fire. In this case, the strife becomes a human right concern and the relief agencies could see the ground as unsafe and delay with supplies resulting in more people affected or dead in the meantime⁴⁵.

However, when nations or regions have certain policy framework, famine can be managed and the impact of population reversed in time. It is imperative to have early warning systems for famine so that appropriate actions can be taken, whether by better farming systems or timely distribution of supplies. Additionally, it is imperative that the human population livelihood systems are enhanced so that people have food support systems. For example, communal farming by consolidation of smaller pieces of land is better than individual farming. Whereas one can fail in an individual small scale farming, in the communal farming the rest of the group becomes a security network for each other. Finally, if populations learn to address farming at their homestead levels such as using irrigated methods rather than relying on rain-fed agriculture, there is likely to be better yields. Such population safety networks have been very successful in previous attempts to manage famine and the cases are replicable⁴⁶.

⁴³ I, Noy, (2009), 'The Macroeconomic Consequences of Disasters,' *Journal of Development Economics*, 88(2), 2009; pp. 221-231.

⁴⁴ M, Skidmore & H. Toya, 'Do Natural Disasters promote long-run growth', *Economic Inquiry*, 40 (4), 2002; pp. 664-687.

⁴⁵ Wisner, et al, Ibid

⁴⁶ Wisner, et al, Ibid

Second, there are disasters caused by biological hazards and whose effect can magnify based on three reasons. Disasters affecting human health are more deadly when a given population or microenvironment is involved, for example food poisoning at a party or gathering. However, if only a small household of family is affected, then the impact is lesser. The type of daily life that people are exposed to determines how exposed they are to biological hazards hence the impact when disaster strikes. These include the ability of people to migrate into areas perceived to be biologically hazardous. Furthermore, if the people live below poverty line, they may not afford basic hygiene commodities and this exposes them to biological hazards such as cholera, leading to disasters. The level of vulnerability to biological hazards determines the proportion of disaster if it strikes in terms of regional physical environment. For example, people working in a biological lab or living near such a plant are likely to be affected if there was a system breakdown. Therefore, most of these biological labs tend to be located away from residential areas aside from the requirement that the workers exercise utmost care to prevent any disaster⁴⁷.

Two types of biological disasters can cause vulnerabilities on people and their environment. First, if the level of genetic defense of the population is low, the impact of the biological disaster can be very serious including causing health problems and death. In most cases, the populations are not used to the biological hazards and this is a predispositional factor for their injury or death. Second, the type of environment or cultural exposure of the population to some biological hazards determines the impact. Therefore, if a community is used to staying at high altitudes, there are less likely to be affected by the biological hazards associated with such environments as compared to people who migrate. The case of the Ebola virus in parts of West Africa is another perfect example of how people can be exposed to biological hazards leading to deadly disasters⁴⁸.

Third, the impact of flood disasters depends on the population density of the affected area and geographical proximity to the location. Therefore, people who live in the flat or lowest regions that are prone to flooding tend to experience greater impact compared to the others in the highlands. Various instances of flooding have been reported as caused

⁴⁷ Wisner, et al, Ibid

⁴⁸ Wisner, et al, Ibid

by heavy down pour with urban areas hit due to poor drainage systems. In some cases, when controlled floods break their banks, the surrounding communities tend to suffer huge impact whether destruction of assets or loss of lives. Additionally, heavy rains can cause landslides, and the people living on the slopes or bottom of valleys tend to suffer the most impact⁴⁹.

Floods cause heavy deaths to people, their livestock and destroy their crops. Floods also immobilize people because many fear drowning incidences. Floods cause very many injuries as the land is covered with water and people are not able to see pit falls. Floods disrupt people lives and causes serious poverty when they cannot pursue their daily bread earning work. A typical example was the flooding experienced in Bangladesh where huge number of people was impoverished while other died. Another example is the perennial floods in China, where due to the country's dense population; the impact is always devastating to human lives and their wealth⁵⁰.

The level of deforestation and the speed of intervention during flooding disasters determine the level of damage or deaths that could occur in any case. This implies that disaster preparedness is a compulsory policy that any government must have especially if the nation or region has a history of these risks. The level of social protection from floods is also very important because it determines how many more lives and property will be saved in any event. This implies that the community must have some flood precautionary measures such as gabion wall constructions, landscaping, and drainage maintenance and alarm systems⁵¹.

The impact of disasters caused by coastal storms depends on the density of population living in such geographical locations. Areas most vulnerable to coastal storms are the hinterlands, islands and other forms of habitations in nearby regions. Coastal storms normally manifest as cyclones and sometimes typhoons. It is important for the government to have a policy of evacuation of persons whenever coastal storms similar to Tsunamis recently experienced in many areas are forecast⁵².

⁴⁹ Wisner, et al, Ibid

⁵⁰ Wisner, et al, Ibid

⁵¹ Wisner, et al, Ibid

⁵² Wisner, et al, Ibid

Earthquakes are another form of natural disasters whose impact depends on the people's habitation near the epicenter or localities that are prone to seismic movements. Some of the past cases of earthquake that caused serious loss of lives in excess of 5,000 are given in Table 7.

Table 7: The Most Devastating Earthquakes in World History

No.	Year	Month	Country	Number of deaths
1	1976	July	China	242,000
2	2010	January	Haiti	222,570
3	2004	December	Indonesia	165,708*
4	2008	May	China	87,476
5	2005	October	Pakistan	73,338
6	1990	June	Iran	40,000
7	2004	December	Sri Lanka	35,399*
8	2003	December	Iran	26,796
9	1998	December	Soviet Union	25,000
10	1978	September	Iran	25,000
11	1976	February	Guatemala	23,000
12	2001	January	India	20,005
13	2011	March	Japan	19,846*
14	1999	August	Turkey	17,127
15	2004	December	India	16,389*
16	1993	September	India	9,748
17	1985	September	Mexico	9,500
18	2015	April	Nepal	8,831
19	2004	December	Thailand	8,345*
20	1976	August	Philippines	6,000
21	2006	May	Indonesia	5,778
22	1995	January	Japan	5,297
23	1987	March	Ecuador	5,000

* Earthquake followed by Tsunami

Source: EM-DAT: The Office of Foreign Disaster Assistance OFDA/CRED International Disaster Database

Out of these, the December 2004 earthquake followed by a Tsunami alone claimed 225,841 lives in Indonesia, Sri Lanka, India and Thailand. The large number of deaths due to earthquakes alone makes a case for government intervention on policy and mitigating action.

2.3 Natural Disasters - Government Intervention and Public Beliefs

- The Volcanic Eruption of Mountain Versuvius in 79 A.D.

In 79 A.D., a volcanic mountain Vesuvius erupted spewing huge clouds of ashes and dust to the environment. The ensuing disaster was record breaking, never seen in the time's history. The Vesuvius volcanic eruptions demolished the Pompeii and Herculian towns and more than 25,000 people lost their lives. Later, it was not possible to reconstruct the two towns because the labor force to do the job was either too weak from the aftermath or wiped out. The Vesuvius volcanic eruptions altered the geophysical appearance of the two towns and the loss of property was of untold proportions. The affluence of the Vesuvius volcanic eruptions such as photochemical smog, filth, dust and thick smoke further causes massive health problems to the people living in the nearby towns. Harsh weather later pushed the smoke and dust towards the South of Europe and the negative impact continued for a long time. It was approximated that hundreds of thousands of people were further affected directly or indirectly especially from the gas and smoke inhalations⁵³.

- The Earthquake in the Holy Land around the year 1546

There are publications about earthquakes that took place in the Holy Land around the year 1546, amongst other natural disasters like famine, rainstorms, volcanic eruptions and floods⁵⁴. In fact, the earthquakes are responsible for shaping the landscape of the Holy Land⁵⁵. Earlier on, many Muslims believed that the Holy Land and Al Aqsa was protected from natural disasters like earthquakes. Nevertheless, on January 1546, a major

⁵³ Vorhies, Ibid, p. 3

⁵⁴ M, Kempe, 'Noah's flood the Genesis story and natural disasters in early modern Times,' *Environment and History* 9, 2003; pp. 151 – 171.

⁵⁵ D, Chester & A, Duncan. 'The Bible, theodicy and Christian responses to historic and contemporary earthquakes and volcanic eruptions,' *Environmental Hazards* 8, 2009; pp. 304 – 332.

earthquake hit Jerusalem and most of the Middle East was affected, leading to the Holy Land faults and massive losses. Even the Holy Tomb was not spared and the nearby Temples collapsed⁵⁶.

- The Aqadir Earthquake in Morocco took place in 1960

The Aqadir earthquake in Morocco took place in 1960. More than 15,000 people died while another 25,000 were injured. A study after the recovery from the earthquake indicated that many less educated people were ignorant on the causes of earthquakes. Rather, many believed that some divine being had been offended and was retaliating with such actions. When the same population was asked if they had any idea on the possible causes of earthquakes, many referred to Allahu a'lam, meaning God knows best. Therefore, the people considered a probe into the possible causes to earthquakes as 'haram'. Other people considered studies into the causes of earthquake as equivalent to fortune telling and equally prohibited by the Quran, therefore, those who survived during the earthquake were protected because they were faithful to God⁵⁷.

The notion that natural disasters were a sign of punishment from God prevailed for a very long time and perhaps to date. Therefore, this belief affected the available natural disaster intervention strategies because there was hesitation for fear of wrath from the almighty. It was always difficult to involve local communities on natural disaster mitigation preparedness because many people in the Middle East invoke religious justifications or cultures to exonerate their roles at personal or communal level⁵⁸.

- The Volcanic Eruption in Nevado del Ruiz, in Colombia in 1985

In the last three decades, there have been numerous regional natural disasters with devastating effects on the communities, businesses and their populations. In 1985, there was a volcanic eruption in Nevado del Ruiz, in Colombia. In Nevado del Ruiz, in Colombia and in the Montserrat volcanic eruptions, the volcanic dust further made life

⁵⁶ N, Ambraseys. 'Historical earthquakes in Jerusalem – A methodological discussion,' *Journal of Seismology* 9, 2005; pp.329 – 340.

⁵⁷ R, Thomas, R. 'Perception of earthquake risk in Agadir Morocco: A case study from a Muslim community,' *Environmental Hazards* 6, 2005; pp. 167 - 180.

⁵⁸ K, Dake, 'Orienting dispositions in the perception of risk an analysis of contemporary worldviews and cultural biases,' *Cross-Cultural Psychology* 1, 1991; pp.61- 82.

unsafe because people inhaled the dangerous gases and dusts in days to follow. In days after the volcanic eruption, the local many residents were unable to rebuild their lives because their assets value and resources were affected by the disaster. It was evident that both Nevado del Ruiz and Montserrat volcanic events lacked early warning systems from their respective governments. Therefore, the residents in these areas were unable to protect themselves from the effects of the volcanic eruptions. The communication of the disaster in these two events was also uncoordinated, leaving the masses to infer inadequate government involvement at the early stages of the eruptions⁵⁹.

- The Dahshour Earthquake in Egypt happened in 1992

The Dahshour earthquake in Egypt happened in 1992. This disaster was at a time when there were widespread Islamic sentiments trying to justify that the recurrent of disasters was mainly due to social or political ramifications. The faithful considered Allah as peaceful and merciful who would not mean harm to the people (Al Azmeh, 1996). Hence, when the Dahshour earthquake happened at the South of Egypt, there was massive Islamic theological debate. In fact, the Muslim faithful prayed even more after this disaster and the young girls were impressed upon to wear the veil. Nevertheless, an Imam Qaradawi indicated that the Dahshour earthquake was a result of unfaithful and corrupt persons in the nation and God was dissatisfied⁶⁰.

- The Kobe Earthquake in 1995

During the Kobe earthquake in 1995, huge populations were vulnerable to its effects especially women, children and the aged. The social security networks were disrupted as people's attention was diverted from jobs to survival and protection of property. The dense populations exposed the people to different risks such as health and food insecurity. The earthquake caused very many buildings to either fall or crack, making them unsafe for human dwellings. The local populations became very vulnerable to poverty because their economic livelihood was disrupted. It appears the local authority

⁵⁹ Wisner, et al, Ibid

⁶⁰ A, Farook & S, Mojahed 'Earthquake A natural disaster or divine message,' *Fadaa*, 2005, Retrieved January 23, 2015, <http://www.vb.fadhaa.com/showthread.php?t=114292>

was not prepared in advance for disaster of such scale, hence the magnitude of death and destruction witnessed. However, due to the unity and sense of purpose, the local communities were resilient and recovered from the earthquake disaster after some time⁶¹.

Other natural disasters were experienced in the Montserrat volcanic eruptions events from 1995 to 1998. In both cases, many people were affected especially those living or working within the geographical vicinity of the volcanic eruptions. Many farmers living in this area were equally affected and their lands awash with rocks and magma causing devastating destructions. The women, children and the older populations are high risk groups caught up in this disaster and many were displaced. The volcanic eruption disrupted normal hygiene, as surface water was polluted leading to unsafe living conditions for human and their animal keeping⁶².

- The Turkey Earthquake in 2000

In 2000, there was a major earthquake in Turkey. Many buildings collapsed, but amazingly, some big Mosques and Catholic Church structures survived, ostensibly due to their sound architectural designs. However, many faithfuls regarded these acts as favour from God because they stand on holy or sacred grounds where their devout worship. Consequently, faithful from these two religions joined hands and participated in the rescue and recovery efforts. Additionally, Hindus from India also joined hands to search and identify the dead bodies⁶³.

- The Gujarat Earthquake in India in 2001

In 2001, the Gujarat earthquake happened in India. Once again, due to the dense population living in these areas, massive lives were lost and property destroyed. The populations were at high risks because most of the houses in this area are storey structured to cope with the high growth of population. Most of the buildings in this Gujarat area were not structurally sound nor approved by the local authority engineers and this became a point of contention with the authorities. Most people living in the Gujarat area were informally employed, hence, when the earthquake happened; they

⁶¹ Wisner, et al, Ibid

⁶² Wisner, et al, Ibid

⁶³ Thomas, p.170.

became more economically vulnerable and poverty-stricken. However, the resilience of the local communities and working together with the government and non-government relief efforts enabled them to come back to sustainable life after some time⁶⁴.

- The Volcanic Eruption in Goma, Congo at Mount Nyiragongo in 2002

In 2002, there was a volcanic eruption in Goma, Congo at Mount Nyiragongo. Again, the thousands of highland dwelling communities were the most affected by the eruption and forced to leave immediately. Nevertheless, there were some fatalities arising from the sick and aged people who could not be evacuated in time. The communities living in the higher altitudes or slopes of this mountain were the most vulnerable from the eruption followed by their neighbors who were forced to accommodate the internally displaced people. Due to the massive human displacement, the available infrastructure and hygiene conditions could not cope with the abrupt population pressure, predisposing unsafe living conditions. There were numerous food and water borne disease outbreaks reported in the weeks after the eruptions. The government in Congo did not seem to have prior information about the impending volcanic eruptions due to inadequate investments in science and technology. Therefore, the population failed to protect themselves from the direct and indirect effects of the eruptions. The international, regional, government and non-government bodies came together to support the internally displaced and harmed people and this action bolstered their resilience eventually⁶⁵.

- The Massive Electricity Blackout in the North America in 2003

In 2003, there was a massive electricity blackout that later caused a technological disaster in the North America. Tree branches that grew high and touched the high voltage power lines around Ohio triggered this problem. Consequently, power supply to that region and further to Ontario in Canada was disrupted. Ordinarily, Ontario has nearly 33% of the entire Canadian population. Nearly 40 million people within 8 states in the

⁶⁴ Wisner, et al, Ibid

⁶⁵ Wisner, et al, Ibid

US (14%) also lacked power due to this crisis. Businesses lost over \$6 billion worth of potential transactions due to this crisis⁶⁶.

- The Indian Ocean Tsunami of 2004

The Indian Ocean Tsunami also had a very serious effect on nations bordering the sea that started on December 26th 2004. Indonesia was the most affected by the effect as the Tsunami events spill over to the 2005. Across Asia, more than 300,000 people lost their lives from the immediate effects of the ocean waves. The effects of the Tsunami were felt by over 25 nations as far as Sweden because the world is interconnected⁶⁷.

Indeed, the Tsunami is regarded as one of the most catastrophic in modern times, considering the people who lost their lives and the toll on injuries and property. Once again, the Muslims in the region regarded the devastations of the tsunami to punishment from God according to various posts on social media and blogs. It was interesting to note that various Mosques and Islamic buildings survived the Tsunami effect. Whereas analysts attributed this resilience to the architectural designs and strengths, many Muslims attributed these as an Act of God protecting his houses of worship. Indeed, the brilliance with which most Mosques are constructed allowed water to pass through and leave the pillars and roofs intact when the Tsunami was washing away many other buildings in Asia⁶⁸.

The impacts of the Tsunami in Sri Lanka were equally devastating with reference to the Queen of the Sea Rail Disaster. As the water waves reached a Sri Lankan village called Peraliya, a train full of people was packed. Soon the railway was covered with water and as the levels rose, several passengers were forced to climb onto the roof for safety. Others who could not get space on the roof of the train stayed inside to hold on against the strong water force. The first water wave did not cause as much damage as the second which rose as high as 18 foot. This wave pushed the train off track and those who were on top fell right into the floods they were avoiding. The water torrents pushed the train on for another 115 km and the people who had originally remained inside the

⁶⁶ Vorhies, p. 7

⁶⁷ Vorhies, Ibid.

⁶⁸ R, Thomas, R.' Perception of earthquake risk in Agadir Morocco: A case study from a Muslim community,' *Environmental Hazards* 6, 2005; pp. 167 - 180.

originally overloaded trains crushed and drowned to death. Other people clinging on the trains' body were dragged along houses and vegetation and this reduced their chances of survival. The Tsunami, having disrupted most of the communication infrastructure disabled people's ability to communicate about the disaster. In the Sri Lanka train incident, over 2,000 bodies were either dead or missing⁶⁹. The picture below illustrates the Tsunamis impact on the Sri Lankan Train.

- The Pakistan Earthquake of 2005

In 2005, there was an earthquake in Pakistan, where more than 90,000 lost their lives. In Northern Pakistan, the earthquakes also caused displacement of persons and destructions of property, which escalated to serious impoverishment of the communities living in the mountainous regions. However, some extremist Mullahs told their Muslim followers to sell away their electronics like TVs, which do not air features and stories according to the Islamic teachings; hence, Allah was provoked to the wrath on human beings. It was interesting to note that no single scholar in Pakistan contradicted the Islamic belief that the earthquake was a punishment from Allah⁷⁰.

As these events were happening in Pakistan, fellow Muslims in places like Sudan and East Africa provided a new dimension to the frequent recurrence of natural disasters like the earthquakes, attributing them to some supernatural forces related to the dead and buried souls⁷¹. Further away in Indonesia, which is regarded as the world's most populous Muslim nation, there was widespread belief that the rampant volcanic Mountain eruptions like Merapi were caused by some spirits⁷². Hence, when the spirits were at peace, everybody living around the mountain was safe⁷³. It was not surprising that until the turn of this century, the people of Java used to offer human and other animal

⁶⁹ Fearn, D. 10 *Devastating (Un)natural Disasters*. Listverse, 2012, Retrieved <http://listverse.com/2012/02/05/10-devastating-unnatural-disasters/>

⁷⁰ Hoodbhoy, P. *Science and the Islamic world The quest for rapprochement*, American Institute of Physics, 2007; pp 49 - 55.

⁷¹ Anon, 'Nature Worship: Earthquake,' *Encyclopaedia Britannica Electronic Version*, 2009, Retrieved January 20, 2015, <http://www.britannica.com/facts/5/421059/earthquake-as-discussed-in-nature-worshipreligion>

⁷² M, Dove, 'Perception of volcanic eruption as agent of change on Merapi volcano,' *Central Java Volcanology and Geothermal Research ELSEVIER* 172, 2008; pp.329 – 337.

⁷³ Schlehe, 2008

sacrifices to appease the volcanic mountain spirits. This practice was later switched to sacrificing chicken to the Broma volcano⁷⁴.

- The Power Grid Disaster of Europe in 2006

In 2006, a power related disaster also hit most sections of Europe. The power grids were overloaded by some industrial activities in Northwest Germany. The engineers were attempting to connect a high voltage power link beyond a German river. The existing line was turned off for safety purposes, so that a brand New Norwegian cruise ship could cross over. During reconnection, power failed in places like Cologne in Germany then the problem spread to France, Italy, Austria, Spain, Netherlands and Croatia. Essentially, most of Europe had a power blackout disaster. It took the engineers several days to restore power in the respective countries while various businesses lost out due to the power disaster⁷⁵.

- The Iceland Eyjafjallajökull Volcanic Eruption of 2010

In 2010, for example, the Iceland Eyjafjallajökull volcanic eruption incident affected the entire airline industry and led to massive grounding or diversions due to poor visibility and air pollution⁷⁶. The volcanic dust and smoke forced the Heathrow Airport in the UK to shut down business for three days in compliance with the international aviation regulations and safety standards. More than 1,000 flights were rescheduled and another 60,000 passengers inconvenienced internationally from this volcanic disaster. Many passengers also complained of misplaced cargo and baggage⁷⁷. In the same year, 2010, there was oil spill at the Gulf coast with estimated that at least 6.1 billion of crude was wasted⁷⁸.

⁷⁴ Sigurdsson, 1999

⁷⁵ Vorhies, p. 7-8.

⁷⁶ Sawada, Bhattacharyay & Kotera, *ibid*, p. 2

⁷⁷ Vorhies, p. 7.

⁷⁸ Reuters, "BP says oil spill costs hit \$6.1 billion" August 9th, 2010, Retrieved January 15, 2014, http://news.yahoo.com/s/nm/20100809/bs_nm/us_bp

- The Hurricane Katrina of 2012

In the same decade, the effects of Hurricane Katrina in 2012 are still memorable. Hundreds of lives were lost and property worth millions of dollars destroyed. Other than the huge number of people who drowned, numerous beach properties and inland assets destroyed. Various other earthquakes caused huge losses and injury to human beings. In Chile, houses were grounded, others cracked, roads and rail systems destroyed, and transport disrupted⁷⁹.

In Haiti, many dwellings were covered with mudslides and multi-storied buildings grounded due to earthquakes. In Sichuan province of China, the earthquakes caused massive destructions to a normally densely populated area and relief efforts extremely over stretched. In Hanshin, Japan, earthquake affected private⁸⁰ and business buildings and some human injuries and the process of rebuilding cost the owners billions of Yen cumulatively⁸¹.

In conclusion, it is evident how natural disasters impact modern global features as well as human lives to the limit of making entire civilizations extinct or move backward in economy for many years. The classification as well as the ranking of natural disasters over the map of the world illustrates the damage capacity over the different areas of the world. It is noted as well how government interventions vary from case to another according to preparedness and assessment of damages.

⁷⁹ Sawada, Bhattacharyay & Kotera, *ibid*, p. 2

⁸⁰ P. E. Auerwald, L. M. Branscomb, T. M. La Porte., and E.O. Michel-Kerjan. *Seeds of Disaster, Roots of Response: How Private Action Can Reduce Public Vulnerability*. Cambridge University Press, 576 pages, 2006.

⁸¹ Sawada, Bhattacharyay & Kotera, *ibid*, p. 2

CHAPTER 3: HISTORY OF NON-NATURAL DISASTERS (A GLOBALVIEW)

3.1 Classification of Non-Natural Disasters According to Hazards

Non-natural disasters are those caused by omissions or commissions of man and are evident all round the world. These non-natural disasters are classified below according to the type of hazard involved.

3.1.1 Anthropogenic hazards

CRED classified the man-made disasters as, first, economic, where there is stagflation, hyperinflation, weakening currency and other related market supply chain crises. These are also referred to as technical hazards. The second category⁸² of man-made disasters or social hazards is breakdown in law and order occasioned by war, acts of terror, violent demonstrations and other forms of activist civil disobedience.

3.1.2 Sociological Hazards

Under this category of main causes of man-made disasters, various classes of civil strife top the list according to converging evidence from researchers. These include terrorism and sabotage, riots and demonstrations, opposition group conflicts, civil wars and other forms of uprisings that generally disrupt peace and tranquility. The Uppsala Conflict Data Program indicates that these incidences have been on the rise in the last two decades⁸³.

A study of 177 nations from 1968 to 200 indicated that the impact of terrorism and other forms of civil strife was slowing down economic growth because the respective government priorities change. The study established that terrorism for example tends to keep away foreign direct investment, leaving the affected country with very few options of sustaining economic growth. The reason for such investment diversion is lack of confidence, fear of destruction of assets, lack of stable and motivated labor force and the

⁸² CRED, 2010, Ibid.

⁸³ UPPSALA Conflict Database (UCDP), UCDP One-sided Violence Dataset v 1.3 1989-2007 and UCDP Battle-related deaths dataset v5 2002-2007, Retrieved January 16, 2015, http://www.pcr.uu.se/research/UCDP/data_and_publications/datasets.htm

infightings. Each of these issues spells out an economic disaster, which is a common observation in many nations currently⁸⁴.

The effects of man-made disasters are felt from an economic cost perspective⁸⁵. Data from 1960 to 1992 indicate that various nations' economic welfare degrade with each major conflict. The study further established that welfare cost arising from terrorism or civil or international wars can decrease social disposable income by 8% and thereby depress their goods and services purchasing power by the same⁸⁶.

3.1.3 Technical Hazards

The process of accounting for the technical non-natural disaster is lengthy just like understanding the economic ramifications. Data shows that the man-made crises have been on the increase for decades. For example, in financial terms, data from 1980s to 1990s indicate that most global currencies did not depreciate to crisis levels yet the number of banks that were closing down or merging with other was on the rise. This phenomenon was later referred to as the 'twin crises'. Three reasons adduced were to explain the causes of some famous economic crises that are related to the twin crisis of 'banking and currency'⁸⁷.

First, many national banks experience huge currency depreciation values which trigger price increases and hasten market buy-offs even when exchange rates are weak. Consequently, the market proceeds to inflationary mood and the value of real income depreciates further⁸⁸.

Second, devaluation of the currency triggers inflation of debt value, which must be settled in foreign currency. However, the financial institutions, which typically operate on the local currency, are pressurized to rely on the foreign currency and this leads to expensive denominations, hence, a man-made economic disaster⁸⁹. Over time, the big

⁸⁴ S. B. Blomberg, G. D. Hess & A. Orphanides, 'The macroeconomic consequences of terrorism,' *Journal of Monetary Economics*, 51(5), 2004; pp.1007-1032.

⁸⁵ Lucas, R. E., Jr. *Models of Business Cycles*. Oxford, UK: New York, NY, USA: Basil Blackwell, 1987.

⁸⁶ Hess, G., 'The Economic Welfare Cost of Conflict: An Empirical Assessment,' Claremont Colleges Working Paper in Economics, 2003.

⁸⁷ G. L/ Kaminsky & C. M. Reinhart, "The Twin Crisis: The Causes of Banking and Balance-of-Payments Problems," *American Economic Review* 89 (3), 1999; pp. 473-500.

⁸⁸ Sawada, Bhattacharyay & Kotera, *ibid*, p. 4

⁸⁹ P. R. Fallon & E. B. Robert Lucas, "The Impact of Financial Crises on Labor Market, Household Incomes, and Poverty: A Review of Evidence", *World Bank Research Observer*, 17 (1), 2002; pp. 21-45.

multinational organizations have to operate with this burden and reduce their labor numbers or reduce wages to remain competitive in their respective market segments. The ensuing labor relations and possible unemployment rates are the face of such economic disasters⁹⁰.

Third, economic disasters occasioned by credit crunch have gone down in history as having some of the most devastating effects on human beings and businesses⁹¹. The small and medium businesses, which typically employ more people than the giant corporations, often bear the most brunt of credit crunch. This is the case as the small and medium businesses rely on the local banks for the capital infusion while the established and listed giant corporations can assess affordable capital across the borders⁹². In the previous credit crunch period, many small and medium businesses could not pay back their capital borrowings and were declared bankrupt. The effects of these business closures are further job loss and cumulative unemployment, under-employment and depressed purchasing power⁹³.

3.2 Brief History of Global Non-Natural Disasters

Numerous man-made disasters have been documented. The choice of cases reviewed in this study is not based on any biases, rather, taking a wider approach of random sampling to advance the objectives of study and enrich understanding from a regional perspective. Therefore, different man-made disasters that cut across industries, timelines and continental regions are canvassed in this study. Fearn⁹⁴ is an author who has published various man-made disaster events by highlighting what, how and why each happened. Indeed, some cases are old but incidentally have been recurring in modern days because the lessons learned and the risk management is inadequate.

⁹⁰ Sawada, Bhattacharyay & Kotera, *ibid*, p. 4.

⁹¹ E, Cavallo & I, Noy, 'The Economics of Natural Disasters: A Survey,' RES Working Papers 4649, Inter-American Development Bank, Research Department, 2009.

⁹² S, Claessens, S, Djankov, & L. C. Xu, 'Corporate Performance in the East Asian Financial Crisis,' *World Bank Research Observer*, 15 (1); 2000; pp. 23–46.

⁹³ Sawada, Y., Nawata, K., Ii, M., & Lee, M. J., 'Did the Financial Crisis in Japan Affect Household Welfare Seriously?' *Journal of Money, Credit, and Banking*, 2010.

⁹⁴ Fearn, D. 10 *Devastating Unnatural Disasters*. Listverse, 2012, Retrieved <http://listverse.com/2012/02/05/10-devastating-unnatural-disasters/>

- The Fidenae Amphitheatre Collapse

The love of man for public sports entertainment is evident from as far back as 27AD. In that year, one of the world's earliest disasters occurred at Fidenae town adjacent to Rome, the Capital City of Italy. A tycoon in that era, called Atilius constructed an amphitheatre using wooden material to commemorate the return of Gladiator Sports after a lengthy ban by Emperor Tiberius. Therefore, the amphitheatre was erected in haste to be ready by a given date. The construction made seating space for 50,000 people inside the amphitheatre. On the D-day, the same number of spectators was present, leading to imminent collapse of the amphitheatre and over 20,000 deaths. Historians consider this as one of the worst stadium disasters globally, the greatest lesson was the birth of modern architecture, where concrete, and steel are used to strengthen stadium construction. Additionally, the Roman senate of that era set a law barring private citizens with less than 400,000 sesterces from convening gladiator sports. A new regulation for construction of amphitheatre was also in place and the Tycoon Atilius was banned from entire Europe⁹⁵. The following figure gives the artistic impression of the collapsed amphitheater in Rome.

- The Santiago Church of Company Fire

On December 8th 1863, Santiago, Chile experienced one of the most memorable unnatural disasters to date inside a church. On the fateful day, the Church of the Company of Jesus had a mass to commemorate the Feast of Immaculate Conception. During the prayers inside the church, a gas lamp to illuminate the occasion caught fire and started burning the wall draping. One of the worshipers moved fast to put out the fire with a second cloth and was unsuccessful, leading the fire to spread to other parts including the church's wooden roofing. Initially, this church had been filled to capacity. According to the church design, the doors normally opened inwards to allow people entry⁹⁶.

As the fire and smoke began to fill the church, the congregation started to evacuate in a panic mode and hence, the huge numbers all trying to come out of the few doors caused it

⁹⁵ Fearn, Ibid

⁹⁶ Fearn, Ibid

to close. The worshipers' pressure eventually rendered all doors closed because the people close to exit were crushed and some fainted while others died. Bodies began to pile at the door points as the fire was still spreading across the church building and consuming the remaining oxygen. Within three hours from the start of the fire, the church roof collapsed on the remaining congregation and the rest of those still breathing were killed. Official figure estimated that 2,000 – 3,000 perished in the church inferno, majority being women, children. Whole families and various bodies were burnt beyond recognition. The church leadership therefore opted for a mass grave for those who could not be identified. The forensic teams spent 10 days removing the bodies while taking care to establish their identities for intention to surrender the same to surviving families. The modern Chilean fire brigade mostly composed of volunteers was developed following this fire disaster⁹⁷.

- The Halifax Explosion of Mont-Blanc Cargo Ship

The Halifax explosion took place on December 6, 1917 at 08.44 am, following attempts by a big Norwegian Ship to leave via a very narrow Halifax Harbour and colliding with another French Cargo Ship called Mont-Blanc. The French vessel had over 2,300 tons on board composed of liquid and powder picric acid, 200 tons of TNT, 10 tons of gun cotton and 35 tons of Benzoyl, which is very explosive. Both ships made errors in their navigation out of the Halifax Harbour and collided with sparks generated as the two massive steel bodies had contact. Therefore, it was easy to light up Benzoyl on board the Mont-Blanc and the fire quickly spread to other places. Mont-Blanc had crew of about 40 who jumped off the ship when they could not extinguish the fire. Meanwhile the Mont Blanc was sailing towards the shore and this attracted a multitude of observers. As Mont Blanc docked, it lit up more fires especially from the gun cotton. The fire escalated out of control and within 20 minutes from the original collision, there was an even bigger explosion from the chemical cargo reaction. A huge ball of smoke was emitted and visible as far as 2 km away⁹⁸.

⁹⁷ Fearn, Ibid

⁹⁸ Fearn, Ibid

The explosion caused the heated parts of the 18 meters tall ship and parts of the cargo to scatter all over the shoreline. The force of the explosions caused houses, factories, schools, churches and other dock facilities within 2 km serious destruction. All the bystanders who had come to witness the burning ship as it came towards the shoreline including kids from nearby schools perished from the impact of the explosion. Many people had gruesome injuries while others blinded from the glass shrapnel at the impact of the explosion⁹⁹.

The shock and awe from the Mont Blanc explosion further caused numerous fires within 2 km and building structures to crack or collapse. Therefore, many people who were not even aware of the primary explosion were victims from their houses. Overall, the explosions obliterated 326 acres of ground surface. Numerous houses, some skyscrapers within 16 km had cracks while other people claimed to hear the sound of the explosion from 316 km away. Metal chips and particles of the Mont Blanc ship were scattered nearly 4 km away from the explosion site. About 1,600 people died during the primary explosion, another 9,000 were injured in the secondary explosion and 1,630 homes collapsed while 12,000 others had cracks. Official figure for the dead were 1950 as miraculously, one crewmember of Mont Blanc managed to evacuate to safety¹⁰⁰. The following figure shows the explosion wreckage from the Mont Blanc shoreline.

- The Chingqong Bombing

The 2nd World War, the bombing of Chongqing a Chinese City, with climax on June 5, 1941 caused quite a disaster. The onslaught by the Japanese forces from all fronts lead to more than 11,500 bombs targeting the city. This strategy of carpet-bombing is quite different from the current warfare where many militaries are more accurate armed opponents only. However, the incident at Chongqing was indiscriminate as innocent families, medical facilities and schools were targeted. On the climax date, the Japanese intensified their bombing of Chongqing for more than 3 hours, prompting members of the public to scramble for the bomb shelters. These facilities were congested with people running for their safety and it was estimated that more than 2,500 – 4,000 people

⁹⁹ Fearn, Ibid

¹⁰⁰ Fearn, Ibid

scrambled into one. As the people in the bomb shelter were waiting for the ordeal to subside, most suffocated to death. Later, a museum was constructed near the site of the disaster as commemoration of their lives every 5th June ¹⁰¹. The following figure illustrates some of the images of the bombing disaster.

- The Benxihu Colliery Explosion

The Benxihu Colliery Explosion in April 1942 is among some of the most memorable man-made disasters to go down in history of risk management. Benxihu iron and coalmine is in China, at a place called Liaoning and had very notorious work environment and conditions according to multiple employee testimonies. Therefore, during the 2nd World War, the Japanese conquered the Liaoning area including the colliery, subjecting the employees to some of the most inhuman conditions ever documented by that time. The Japanese forces assaulted the workers, denied them food and held them in very unhygienic environment that Typhoid and Cholera thrived¹⁰².

Poor maintenance of the colliery led to an explosion of the gas shafts on April 26th 1942. Consequently, flames were emitted from the colliery entry point. The Japanese forces then decided to keep away the members of the public from the disastrous colliery, first, by electric fencing it off and second, by ordering the surviving workers to service the shafts and bury the dead in mass graves during the nights for more than 10 days. The following image is an artist impression of the colliery explosion.

It was impossible to identify the colliery workers because most had over 90% burns while other had suffocated from the carbon monoxide emitted during the colliery explosion. The Japanese forces denied that the disaster happened and partially reported that only 34 people lost their lives. However, when the Soviet Union forces defeated the Japanese forces and excavated the mass graves, about 1,549 bodies were found, of which 31 were Japanese. This death toll represented 33% of the entire workforce at the colliery¹⁰³.

¹⁰¹ Fearn, Ibi7

¹⁰² Fearn, Ibid

¹⁰³ Fearn, Ibid

- The London Great Smog of 1952

The air pollution disaster of London in 1952 has a place in history as one of the most eventful. Ordinarily, London was dotted with various industries, which omitted smokes to the environment, causing serious pollutions as the race for industrial revolution climaxed. Most buildings in London had a greenish color from the pollution, hence the term 'Pea Soupers'. However, the most serious of all was 'The Great Smog of 1952' otherwise called 'The Big Smoke' which engulfed the city for 4-5 days in December 1952. This year, the winter was equally cold and most residents in London had to use more coal energy, meaning, more Sulphur Dioxide into the environment. Around the same year, the industrialists have innovated new car exhaust for the diesel engines and the emissions were unusually high. Put together, the smoke from London's industries, cars, homes combining with the windy moves from the rest of Europe blowing over London spelt a disaster of its kind. The smog was so dense that it was gaining entry into people's homes every time they opened doors or windows. Consequently, there were mass respiratory infections in London. Before the 'Clean Air Act of 1956' was legislated, more than 4,000 people died from air pollution related ailments and possibly another 100,000 treated in hospitals. Different sources later corrected the figure upward of 12,000 for deaths¹⁰⁴. The figure below illustrates the state of smog pollution in London in 1952.

- The Banqiao Dam Disaster

In 1952, the Banqiao dam was launched to manage the regular floods disturbing the residents around Huai River basin. This dam was able to generate at least 18 GW of power to most parts of the Henan Province, China. Nevertheless, no sooner had the dam been commissioned than cracks were evident. Therefore, the Chinese government contracted some Soviet experts who promptly solved the problems and the dam would be regarded as the strongest with a new name 'The Iron Dam'.¹⁰⁵

According to the original design, the Banqiao dam was supposed to hold 300 mm of rain daily. This target was extremely rare and had not been expected in over a century.

¹⁰⁴ Fearn, Ibid

¹⁰⁵ Fearn, Ibid

Nevertheless, Typhoon Nina in August 1975 sweeping across the Henan Province in China yielded about 1060 mm of rain in a single day whereas by that decade, the region had up to 800 mm in a year. Typhoon Nina disrupted most of the Province communication system; hence, the signals by the site engineers to release the dam's water gates and avert disaster were not relayed. Consequently, the supporting dams upstream to Banqiao burst their banks leading to the later water level reaching a record 0.3 meters more than the walls designs¹⁰⁶. The following image illustrates the extent of damage by the Banqiao Dam disaster.

Overall, the engineers approximate that 78,800 tons /sec of water pressurized the Banqiao dam since all the other 62 upstream dams with capacity of 15.783 tons had failed. The water pressure reached 10 km radius and 7m depth moving at 50km/h. The damage from the floods covered surfaces up to 55 km long and 15 km breadth, resulting into a mini lake of 12,000 km². As mentioned earlier, the evacuation coordination did not work smoothly because the communication systems were disrupted by the floods. The conservative figure from China indicates that 26,000 persons died from the Banqiao dam disaster. Another 145,000 died from the secondary effects such as hygiene, lack of food and other related ailments. Overall, more than 11,000,000 people suffered by these floods, as was alleged in a film documentary called Dam999¹⁰⁷.

- The Tenerife Airport Disaster

The Tenerife airport disaster in 1977 stands out among the 1970s events. This event happened precisely at 17:07 hours on March 27th 1977 following a bomb suspected to have been planted at Gran Canaria airport. Therefore, most planes hoping to land at Gran Canaria airport were diverted to land at the Tenerife North Airport, Los Rodeos. Some of the big airlines that were diverted to Tenerife airport include KLM 4805, Pan Am 1736 and some Boeing 747s. Since Tenerife airport was used to less landing and takeoff traffic, the destination and air traffic controllers were suddenly overwhelmed. Eventually,

¹⁰⁶ Fearn, Ibid

¹⁰⁷ Fearn, Ibid

Tenerife airport was congested and some planes had to park on the taxiway, quite against the International Air Travel Authority (IATA) regulations ¹⁰⁸.

Next, planes started blocking each other on the taxiway and the air traffic controllers seemed to be losing their grip of the situation. Meanwhile, the Tenerife airport environment was becoming foggy by the hour and the air traffic controllers and incoming plane pilots were complaining about poor visibility. Two planes KLM 4805 and Pan Am 1736 moved to the single runway and prepared to takeoff; however, the air traffic controllers could not see the planes clearly, as much as the pilots could not see the towers. There was a total confusion in communication between the KLM 4805 pilots and the air traffic controllers as follows¹⁰⁹.

Whereas the air traffic controllers started by explaining to the pilot what would happen when the actual takeoff commences, the pilots interpreted information to mean they were actually on instructions to takeoff. Somewhere along the conversation, the co-pilot said the following on radio, “We’re now at take-off,” and the air traffic controller responded, “OK.” In essence, the co-pilot was actually telling the controllers their real position on the runway to takeoff, whereas the controllers interpreted that the KLM 4805 was still standing at takeoff position. Next, the KLM 4805 co-pilot stated via radio, “Stand by for take-off, I will call You.”¹¹⁰

Within second, the Pan Am 1736 pilots sent a radio message to the air traffic controllers that the runway was not very visible and even the communication had some destructive interferences. Hence, some messages from the Pan Am 1736 pilots could have been missed by the control towers. Within less than three minutes, the KLM 4805 plane gained speed on the runway, its pilots and those of Pan Am 1736 were finally able to see each other’s planes. The Pan Am 1736 pilots decided to take an abrupt right turn at full speed towards the fourth runway exit. On the other hand, the KLM 4805 pilot tried to rise up the plane steeply resulting in dragging the long tail on the runway for nearly 65 feet. As the KLM 4805 plane attempted to lift from the runway, the Pan Am 1736 hit its bottom side. Therefore, KLM 4805 was damaged on the tail and underside while the Pan Am 1736 was damaged on the upper side with most part ripped away. The KLM plane engine

¹⁰⁸ Fearn, Ibid

¹⁰⁹ Fearn, Ibid

¹¹⁰ Fearn, Ibid

stopped and dived 500 ft. in the air before falling 1000 ft. to the ground. Overall, 583 people died with all on the KLM 4085 being 248, while 335 out of the 396 of the Pan Am 1736 also succumbed¹¹¹.

- The Bhopal Gas Leak Disaster

India and the rest of the world will forever remember the 2nd and 3rd December 1984, when Methyl Isocyanate (MIC) gas leaked from a pesticide manufacturing plant in Bhopal. The company Union Carbide stated to the press that the accident happened because water had leaked into the tank holding about 42 tons of the deadly gas. Consequently, there was some reaction, which increased the tank temperature to 200°C, followed by rise in pressure. The tank emitted some dangerous gases to the environment that spread fast with the winds around Bhopal. The first people to get into contact with the toxic gases had coughs, watery eyes, nausea, breathlessness and dizziness. The next morning, many people in Bhopal had different symptoms of sickness and those inside and nearby the plants started evacuating to far distance¹¹².

As the effects of the toxic gases took toll on more people, there were complaints of respiratory failures, blurred vision, and stomach discomfort, orifice bleeding and mass deaths. In the early days, over 170,000 had medical attention to stabilize their reaction to the MIC gas pollution. The Indian government carried out mass disposal of bodies, by burying, cremating or into the Narmada River. NGOs stated that more than 8,000 people died within the first 48 hours of the MIC gas leak and a similar number in the subsequent days. Other sources placed the number of deaths at 30,000 because Bhopal is a densely populated area. The local and nearby town hospitals reported that 100,000 to 200,000 were treated different signs of MIC poisoning. Geologists claim that most of the land within 3km radius from the pesticide factory is contaminated with the MIC residue to this decade. Since this disaster was a gas leak, the residue is about 40 times more concentrated than the required standards. Additionally, most of the land and water around Bhopal has high residue level of heavy metals like Cadmium, Arsenic, Mercury, Lead

¹¹¹ Fearn, Ibid.

¹¹² Fearn, Ibid.

and Chromium al being key ingredients for making herbicides¹¹³. The following photo illustrates the images of the Bhopal Gas Leak disaster.

- The Bradford City Stadium Fire

The Bradford City Stadium fire in 1985 is another illustration of how human negligence can cause serious disasters. The front section was constructed using wood for 74 years and the stadium management had been contemplating renovation with some stronger and safer material but no action was forthcoming. However, there was a resolve on 11th May 1985 after the end of the season to renovate the stadium as part of the wooden structures were showing obvious gaps and openings where supporters litters were falling and could escalate fire incidences. On the last match of the season, one spectator threw a smoldering cigarette but inside one of these wooden gaps and this ignited fire from the accumulated litter. As the first half of the match approached, the fire and smoke spread out along the wooden structure towards the VIP stand. There was pandemonium in the stadium as hundreds of spectators tried to put it out. Overall, 56 people died and another 265 injured¹¹⁴.

- The MV Dona Paz Disaster

The MV Dona Paz cruise ship disaster on December 20th 1987 was worse than the Titanic. Actually, the Titanic disaster ranks 5th worst in terms of fatalities around the world. The MV Don Paz was going to Manila in Philippines with about 1,583 people on board and 58 crewmembers, quite within its licensed capacity, at least on paper. On its way to Manila, MV Dona Paz was involved in head collision with MT Vector, an oil cargo ship with 8,800 barrels on board. One of the passengers on the MV Dona Paz indicated that the fateful night had calm weather but the strong sea waves made the ship navigation problematic¹¹⁵.

On the impact of collision between the two ships, MT Vector carrying gasoline ignited fire, which covered the entire cargo vessel spontaneously. The impact of the explosion caused the MV Dona Paz lights to go off. As the ship rocked aggressively, the passengers were unable to locate life jackets to jump out to safety. Therefore, numerous passengers

¹¹³ Fearn, 2010

¹¹⁴ Fearn, Ibid

¹¹⁵ Fearn, Ibid

had to dive into the sea known to have sharks. The ship's captain did not radio emergency for nearly eight hours and it took a similar duration to mobilize for rescue efforts. About 26 people from the MV Dona Paz ship managed to swim afloat, with two members of MT Vector Crew¹¹⁶. When the MV Dona Paz started the voyage, the passenger manifest indicated that 1,583 were on board. However, most of the survivors contradicted this account, counterclaiming that nearly 3,000 – 4,000 passengers were on board.

The survivors backed their testimony with clarification that the extra passengers were sleeping on the walkways and corridors while some beds had nearly 4 people. The first undeniable evidence of the overloading in MV Dona Vaz was the findings that out of the first 21 bodies recovered, only one was on the official passenger manifest list. Another 2000 people were alleged missing from their relatives and friends who testified that they boarded the fateful MV Dona Paz, yet their names were never listed in the passenger manifest. Later, the official deaths reported were 1,749 while an alternative figure issued by the World Almanac was 4,341, ranking this as leading fatality in the entire century¹¹⁷.

In conclusion, according to its classification as well as the various occurrences of man-made disasters, the harm caused by non-natural disasters is clearly evident to have resulted in huge losses of life and asset. In addition, it has been in some cases worse in consequences and fatality than the natural ones. Countries' policies on strict safety rules, regulations and measures highly contribute to limitation of such unanticipated damages.

¹¹⁶ Fearn, Ibid

¹¹⁷ Fearn, Ibid.

PART 2: DISASTERS IN ABU DHABI

CHAPTER 4: THE EMIRATE OF ABU DHABI

4.1 Geographical and Political Features of the Emirate of Abu Dhabi

The United Arab Emirates, popularly known as the UAE, is a federal absolute monarchy in Western Asia at the southeast end of the Arabian Peninsula on the Arabian Gulf, bordering Oman to the east and Saudi Arabia to the south, as well as sharing maritime borders with Qatar to the west and Iran to the north. From centuries to recent times, this area has witnessed an extraordinary shifting of economic and social activities. The UAE is situated at: Latitude: 22¼ - 26.5¼ North; Longitude: 51¼ - 56.5¼ East.

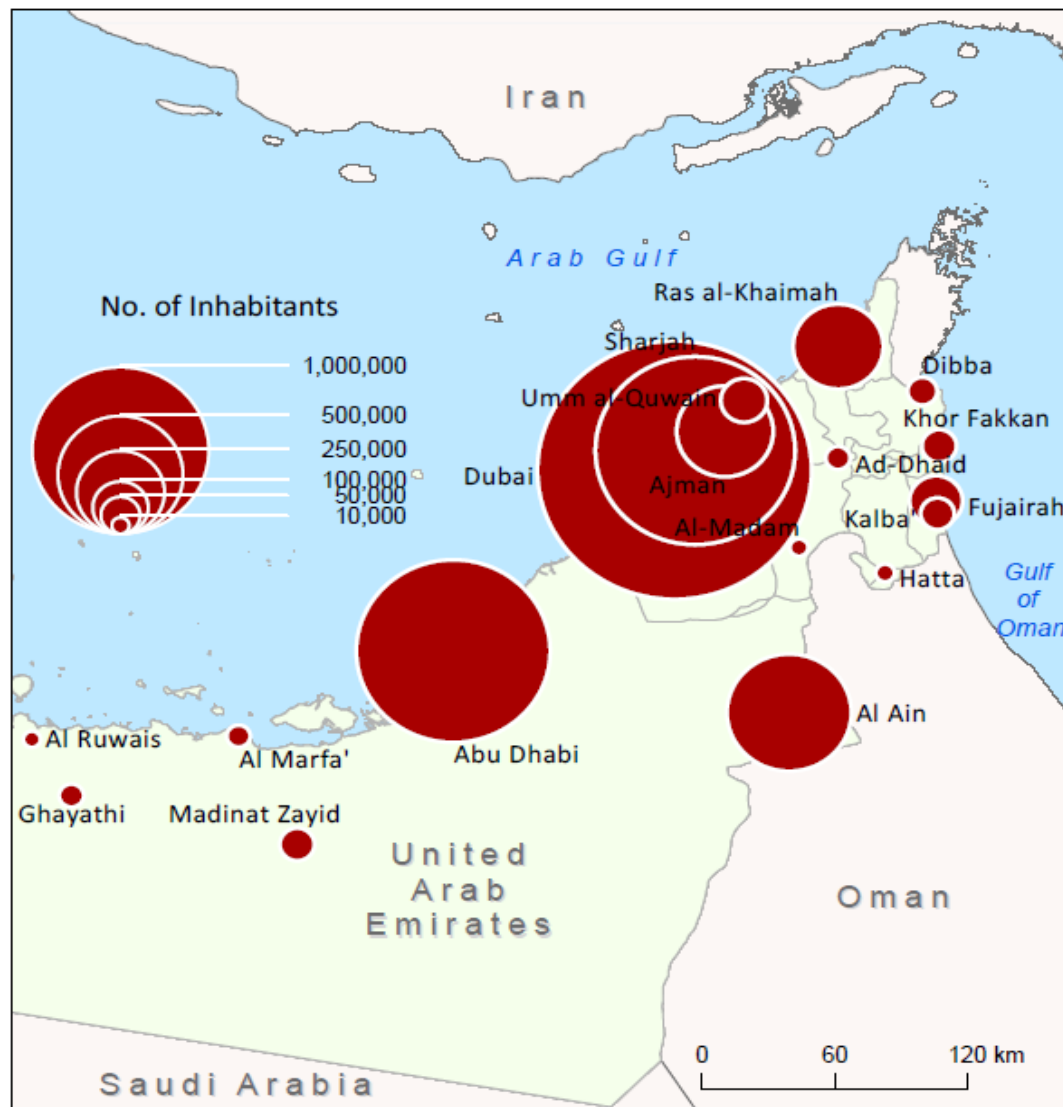
According to the 2013 census, the UAE's population was 9.2 million, of which 1.4 million are Emirati citizens and 7.8 million are expatriates. According to the official portal of the UAE Government, there are more than 200 nationalities living and working in the UAE. The expatriate community outnumbers the population of UAE nationals which provides an extraordinary shape of a multicultural society and economy. Indians form the largest foreign community in the UAE, followed by Pakistanis, Bangladeshis, other Asians, Europeans and Africans.

Established as a federation of seven emirates on 2 December 1971, the area is large of approximately 85,000sq km. Constituent emirates are Abu Dhabi (which serves as the capital), Ajman, Dubai, Fujairah, Ras al-Khaimah, Sharjah and Umm al-Quwain. Each emirate is governed by an absolute monarch; together, they jointly form the Federal Supreme Council. One of the monarchs is selected as the President of the United Arab Emirates. Abu Dhabi city was declared the capital of the UAE Federation on July 1996, as approved by the UAE Supreme Council.

Abu Dhabi, a simple island settlement transformed within a short period of time from a small town of few hundreds palm huts, few coral buildings and the local leader's fort to a vibrant one million city with creative shape of a new city structure. Nowadays, this city alone accounts for 87 per cent of the country's total landmass inhabited with less than 50,000 inhabitants at the beginning of the 1970 decade to nearly 130,000 inhabitants in 1975, about 285,000 inhabitants in 1985, 400,000 in 1995, 560,000 in 2005 and 930,000 in 2015. Foreign migration is the main contributor of the growth and expatriates constitute about 80% of the city population.

However, the largest emirate by population is Dubai, with about 35 percent of the population, at over 2 million people. The second largest emirate by population is Abu Dhabi, which is home to over 31 percent of the country's population. Abu Dhabi is the largest emirate in area, making up over 87 percent of the country, followed by Dubai and Sharjah, the following map shows the UAE major cities inhabitant.

Figure 8 (A) Population of Major Cities and Towns of More than 10,000 Inhabitant 2015

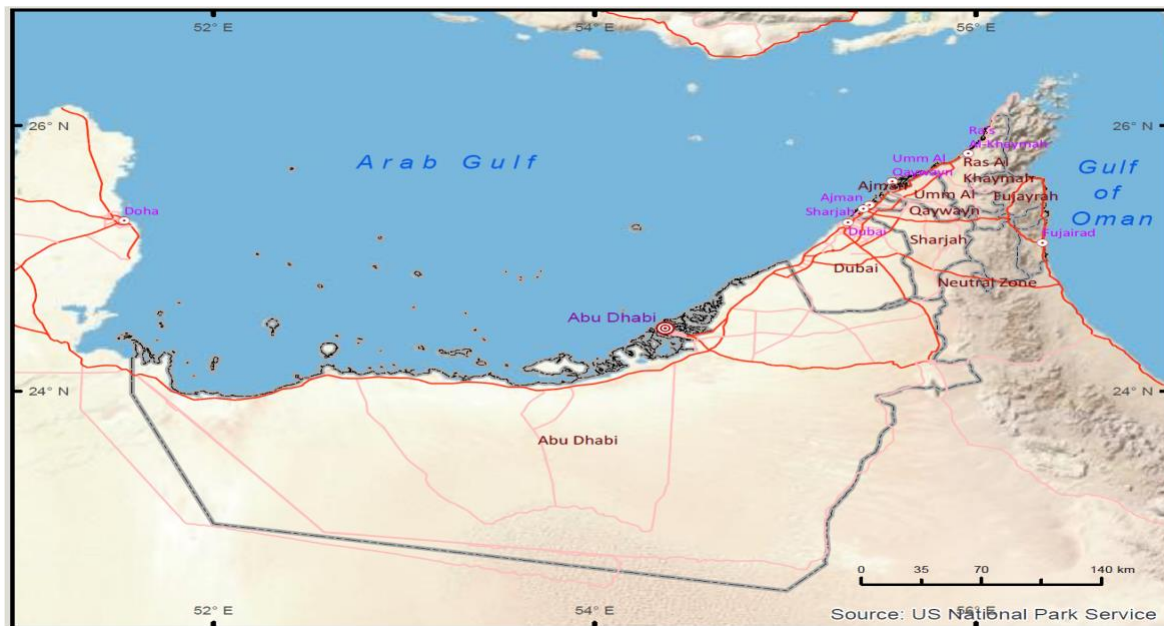


Source; Ahmed Al Marzooqi 2017

Islam is the official religion of the UAE and Arabic is the official language (although English and Indian dialects are widely spoken, with English being the language of business and education particularly in Abu Dhabi and Dubai).

The country's location on the Gulf region allows many nations easy access to the country for trade, work, joint businesses and other reasons¹¹⁸. The UAE is a strategic entry and exit to other global markets especially the petroleum economies in the Middle East as it serves the seventh-largest oil reserves in the world and the seventeenth largest natural gas reserve according to statistics. The UAE has various gas and oil reserves other than being surrounded by numerous landmark features rich in geological history. The UAE is geographically located at the Arabian Plate, which is largely made up of rocks from the Cambrian period nearly 500 million years old¹¹⁹. The UAE landscape is dominated with salt diapirs, oil fields, sand dunes, and Cambrian rock surfaces¹²⁰. The rest of the UAE is dominated by sandy surfaces and this goes from the Hajar Mountains to the Rub al Khali. The following figures are the satellite illustration of the geographical features and physical features of the UAE.

Figure 8 (B): The Geographical Features of UAE



Source; Ahmed Al marzooqi 2017

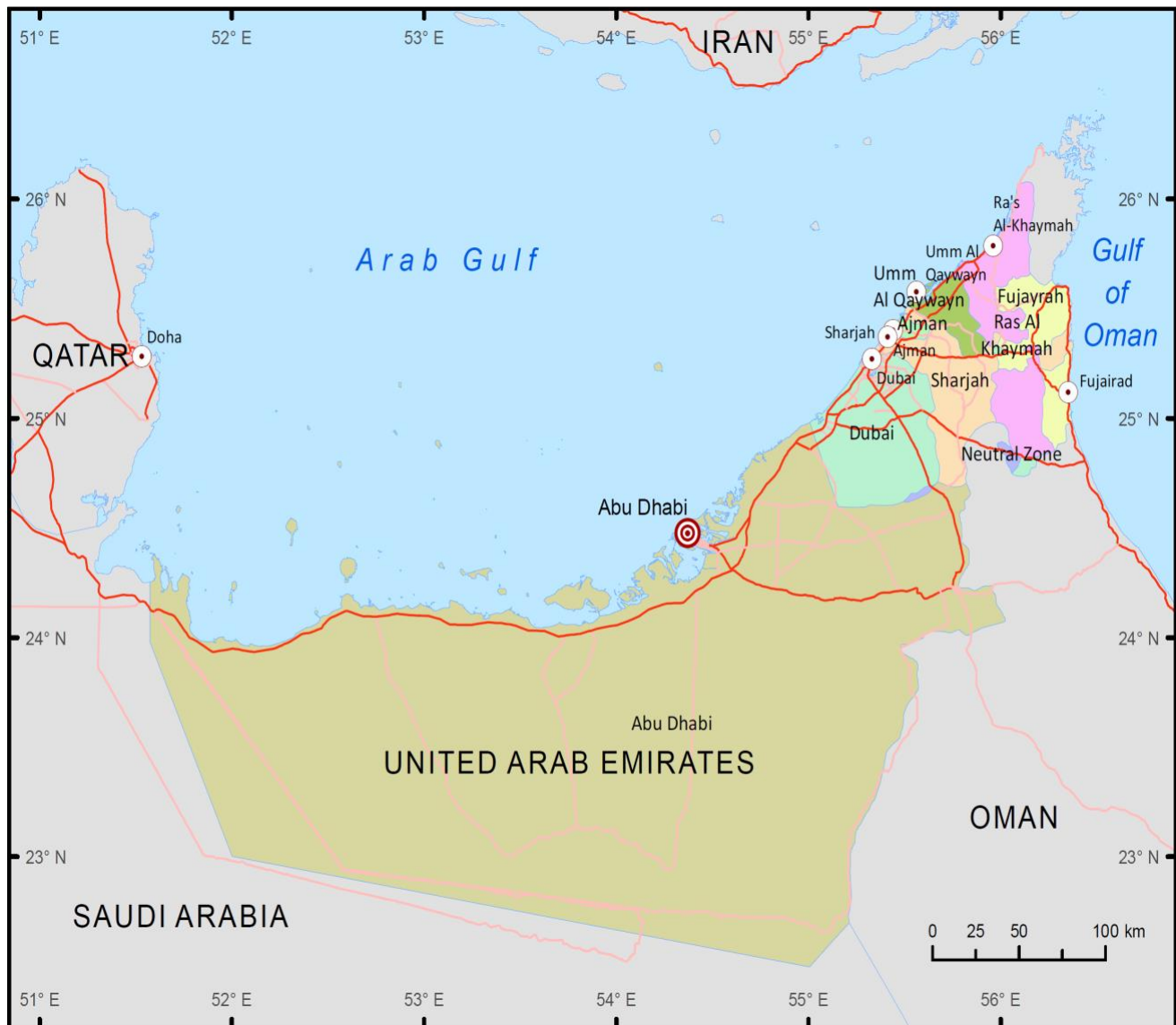
¹¹⁸ Khondker, p. 4.

¹¹⁹ UAE Interact, *Geological Overview*, 2002, p.40, Retrieved https://www.uaeinteract.com/uaeint_misc/teanh/005over.pdf

¹²⁰ UAE Interact, 2002, p. 44.

Source; Ahmed Al Marzooqi 2017

Figure 9: Political Features of UAE



Source; Ahmed Al Marzooqi

UAE has the second largest economy in the GCC (after Saudi Arabia), with a gross domestic product (GDP) of \$377 billion (1.38 trillion AED) in 2012. Since independence in 1971, UAE's economy has grown by nearly 231 times to 1.45 trillion AED in 2013. The non-oil trade has grown to 1.2 trillion AED, a growth by around 28 times from 1981 to 2012. UAE is ranked as the 26th best nation in the world for doing business based on

its economy and regulatory environment, ranked by the Doing Business 2017 Report published by the World Bank Group.

Although UAE has the most diversified economy in the GCC, the UAE's economy remains extremely reliant on oil. With the exception of Dubai, most of the UAE is dependent on oil revenues. Petroleum and natural gas continue to play a central role in the economy, especially in Abu Dhabi. More than 85% of the UAE's economy was based on the oil exports in 2009.

While Abu Dhabi and other UAE emirates have remained relatively conservative in their approach to diversification, Dubai, which has far smaller oil reserves, was bolder in its diversification policy. In 2011, oil exports accounted for 77% of the UAE's state budget. Successful efforts at economic diversification have reduced the portion of GDP based on oil/gas output to 25%. Dubai suffered from a significant economic crisis in 2007–2010 and was bailed out by Abu Dhabi's oil wealth. Dubai is running a balanced budget, reflecting economic growth. Tourism acts as a growth sector for the entire UAE economy. Dubai is the top tourism destination in the Middle East. According to the annual MasterCard Global Destination Cities Index, Dubai is the fifth most popular tourist destination in the world. Dubai holds up to 66% share of the UAE's tourism economy, with Abu Dhabi having 16% and Sharjah 10%. Dubai welcomed 10 million tourists in 2013. The UAE has the most advanced and developed infrastructure in the region. Since the 1980s, the UAE has been spending billions of dollars on infrastructure. These developments are particularly evident in the larger emirates of Abu Dhabi and Dubai. The northern emirates are rapidly following suit, providing major incentives for developers of residential and commercial property. Property prices in Dubai fell dramatically when Dubai World, the government construction company, sought to delay a debt payment.

4.2 Governance and Administrative Features of UAE

After Independence in 1971, the UAE began to be governed under the seven emirates, each having its own constitution to outline how the Federal authorities and institutions should function. However, specific roles were set aside for the emirates to oversee especially those pre-existing before the new Federal constitution was promulgated. The

UAE Constitution Article 120 and 121 stipulates that the Federal Authorities shall supervise the following functions:

Ministry of Foreign Affairs, Ministry of Security and Defence, Ministry of Nationality and Immigration, Ministry of Education, Ministry of Public Health, Ministry of Finance, Ministry of Transport and Ministry of Communication. Moreover, the Federal Authorities are responsible for banking operations, securing borders and extradition of persons under criminal justice process¹²¹.

The governance of the UAE is a combination of traditional and civilized approaches to ensure the country is secure and prosperous. Therefore, the Federal system is composed of the Supreme Council of Ministers or Cabinet, the Federal National Council or parliament and the Federal Supreme Court. The Supreme Council is responsible for electing the President and his Deputy from its members and the electorate could serve for five years renewable. The current President H.H. Sheikh Khalifa bin Zayed Al Nahyan was re-elected for a second term in November 2009¹²².

Next, the President appoints the Prime Minister who is also the Deputy President to oversee the constitutional dispensation and after endorsement by the Supreme Council. The Prime Minister selects the UAE Cabinet then the Presidents second for appointment. One approach by the UAE government is the unification of the local and federal rules via clear regulations and decrees, administered to enhance development and harmony among the population. These two levels of governance are also responsible for updating the current laws to serve the people better and address their changing needs according to the structures illustrated in Appendix B. According to the UAE Constitution Article 62, the Prime Minister together with the Federal Ministers are not allowed to participate in other professional jobs or businesses since this can create conflict of interest and divide their attention from the public services¹²³.

Whereas the governance of the UAE is largely by monarchy, there have been systematic clamor for democratic process to elect leaders. These agitations are trickle in effects from the recent political activities in Saudi Arabia, Bahrain and Kuwait that the

¹²¹ UAE Interact, *Political System*, 2014, Retrieved
http://www.uaeinteract.com/government/political_system.asp

¹²² UAE Interact, *Political System*, 2014, Ibid.

¹²³ UAE Interact, *Political System*, 2014, Ibid.

respective militaries were successful in quashing. Some of the most memorable public elections were in 2006 where some 20 members of the Federal National Council (FNC) were empowered to debate in the parliament. The other 20 were chosen via Electoral College as independent candidates from a pool of 450 interested persons. By 2008, at least 21% of the FNC memberships were female, and the UAE boasted of a bigger gender ratio compared to some of the renowned western nation democracies¹²⁴.

Overall, the election process in UAE requires more civil education to acquire public buy-in and participation. The civil society has been very aggressive in the democratization of UAE to strengthen the national and regional governance¹²⁵. The elections were as a symbolic break from the earlier tradition of nominating members, a system that prevailed from 1972 just a year after elections to 2006. The election envisioned an inclusive participation of the public in the governance of the country¹²⁶.

The next elections after that of 2006 were held in 2011. This time the Electoral College was three time the original. However, just a single woman was elected even though the Electoral College was 46% of the FNC members in 2011 as opposed to the 17.6% during 2006. Nevertheless, in 2011, there were 7 women in total in the FNC equivalent to 18% of the entire parliament. The political changes sweeping globally were responsible for the increasing number of women participation in mainstream UAE politics. Some of the key election campaign policies were to increase access to education, improve distribution of resources and revival of the young people's dreams to succeed in life. The issues of women empowerment in the UAE have been gaining prominence and the parliament has been discussing ways of reducing marginalization. Therefore, the UAE elections were a gradual achievement of the democratic space, foundation of economic growth and regional stability¹²⁷.

The UAE government resorted to electoral system to gain more confidence and trust from the public. Earlier, the UAE governed exclusively by monarch system, the political agitations sweeping across the region were likely to spill over into the nation, and the leadership sought a proactive response. However, the UAE leadership was aware that

¹²⁴ Khondker, p. 5

¹²⁵ Khondker, p. 5.

¹²⁶ UAE Interact, *Political System*, 2014, Ibid.

¹²⁷ UAE Interact, *Political System*, 2014, Ibid.

some more advanced democracies were much divided post-election results; therefore, a blend of elections and appointments was affected to minimize sectarian revolts¹²⁸.

The UAE Governance strategy for after the 2011 election was to ensure each Federal region as a separate budget for development. The objective of this governance approach was to enforce good leadership principles, accountability, reduce wastage, stimulate creativity and start ambitious projects that address people's needs. The new UAE governance strategy anchors on seven principles as shown in Appendix C¹²⁹.

The UAE Local Government is organized along the seven emirates with Abu Dhabi being the biggest of all. Consequently, Abu Dhabi has a separate Executive Council lead by the Crown Prince H.H. Sheikh Mohammed bin Zayed Al Nahyan. Abu Dhabi further has a separate Environment, Tourism, Health, Culture and Heritage Authorities for smooth operations. Municipal councils further govern the Emirates of Abu Dhabi and Al Ain. Emirates of Sharja and Ajman have executive councils and courts for their regions. Governance of the far away locations of UAE is coordinated via the Emir or Wali elected from the local populations¹³⁰.

The Federal and Local leaders are empowered by the UAE constitution to delegate some powers such as issue to do with the armed forces and representation in the OPEC. Overall, the coordination between the Federal and Local government is progressive and governed with utmost competency. Nevertheless, the UAE governance still embraces the traditional approaches simultaneously. The justification for including the traditional governance is to improve service delivery¹³¹.

Ordinarily, the traditional governments are narrower in scope and aim at addressing the special needs or remote communities so that they do not lag in developmental agenda. The most common types of traditional governance involve the Majlis, which the UAE locals value and utilize to participate in debates on the current affairs. These traditional councils also accord the population a mode of direct democracy even though most of the procedures are undocumented. The Majlis convene regularly and with utmost transparency so that any personal views express openly. The Majlis are only workable at

¹²⁸ UAE Interact, *Political System*, 2014, Ibid.

¹²⁹ UAE Interact, *Political System*, 2014, Ibid.

¹³⁰ UAE Interact, *Political System*, 2014, Ibid.

¹³¹ UAE Interact, *Political System*, 2014, Ibid.

the small communal levels because they are potential trouble events if the population is bigger¹³².

The UAE government invokes direct communication with the Majlis depending on the policies and circumstances of rule. Thus, it is common for the UAE government to deal directly with the people and bypass the Majlis rulers when difficult policies are deliberated. The UAE government endeavors to a balanced strategy of the democratic and traditional leadership where the public participation and consensus build gradually with a developmental agenda in mind¹³³.

4.3 The Abu Dhabi Economic Vision 2030

The Abu Dhabi Vision 2030 is “a sustainable, diversified, high-value added economy that encourages enterprises and entrepreneurship and well integrated in the global economy leading to better opportunities for all”¹³⁴. The immediate objectives of the Economic Vision 2030 are to create a sustainable national economy and regulate social and regional economic strategies for all parties’ satisfaction. Furthermore, the UAE Economic Vision 2030 is guided by the following Seven Principles¹³⁵ illustrated below:

1. Build an open, efficient, effective and globally integrated business environment.
2. Adopt a disciplined fiscal policy that is responsive to economic cycles.
3. Establish a resilient monetary and financial market environment with manageable levels of inflation.
4. Drive significant improvement in the efficiency of the labor market.
5. Develop a sufficient and resilient infrastructure capable of supporting the anticipated economic growth.
6. Develop a highly skilled, highly productive work force.
7. Enable financial markets to become the key financiers of economic sectors and projects.

The following figure depicts the organizational framework of the Economic Vision 2030¹³⁶.

¹³² UAE Interact, *Political System*, 2014, Ibid.

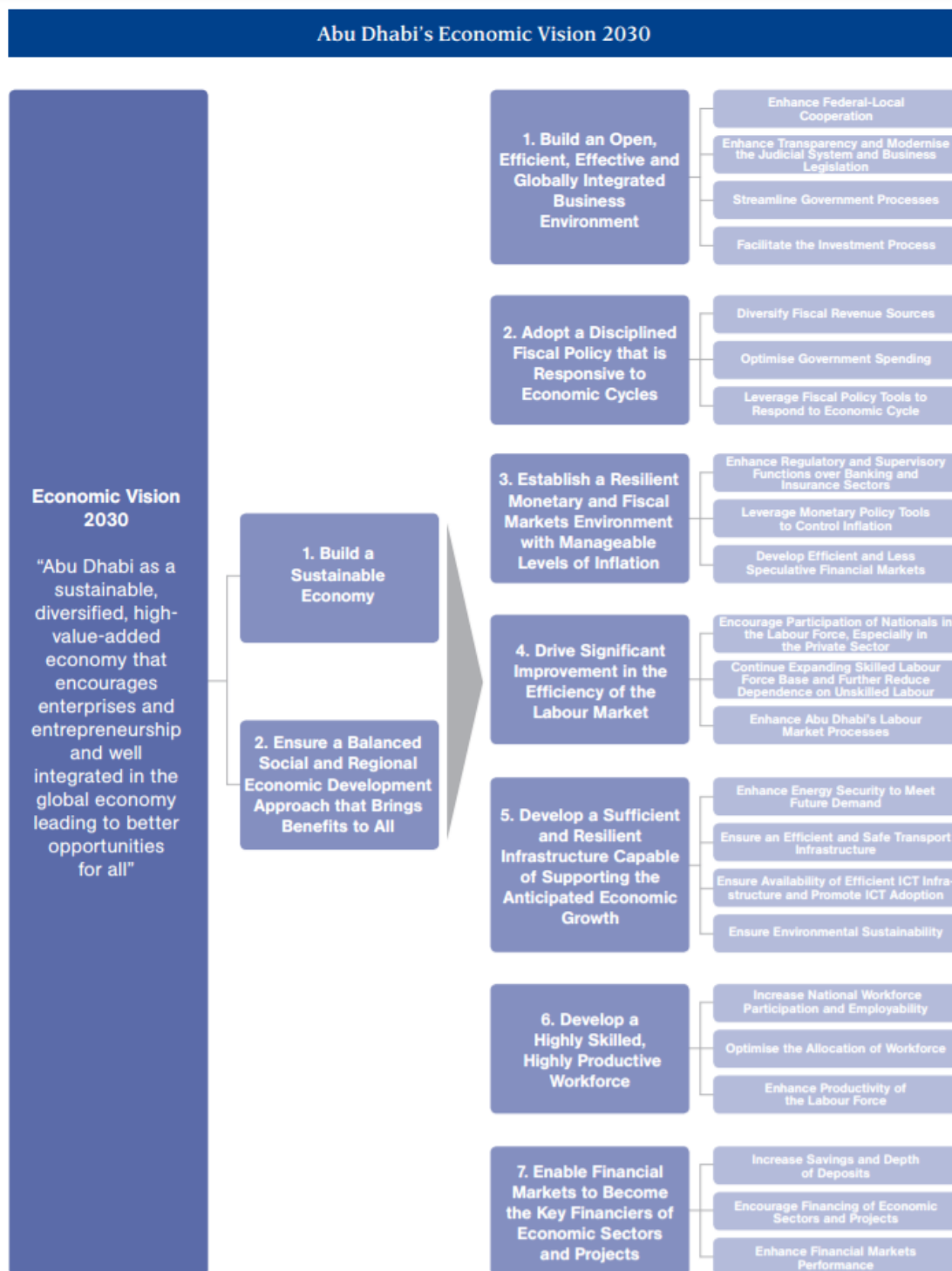
¹³³ UAE Interact, *Political System*, 2014, Ibid.

¹³⁴ The Abu Dhabi Economic Vision 2030, *The Government of Abu Dhabi*, November 2008, p. 17
Retrieved <https://www.ecouncil.ae/PublicationsEn/economic-vision-2030-full-versionEn.pdf>

¹³⁵ The Abu Dhabi Economic Vision 2030, p. 18

¹³⁶ The Abu Dhabi Economic Vision 2030, p. 19.

Figure 10: Abu Dhabi Economic Vision 2030



Source: The Abu Dhabi Economic Vision 2030, p. 19.

- Immediate Objective: Building a Sustainable Economy

In the last decade, Abu Dhabi demonstrated one of the fastest growing economies globally. Consequently, the Abu Dhabi Economic Vision 2030 was rolled out to consolidate and further these achievements. In retrospect, the Abu Dhabi per capita growth was leading in the GCC and other places around the world. The Abu Dhabi citizens have been getting wealthier and life expectancy is increasing. The global demand for oil and gas from UAE also bolsters the economic growth of the region¹³⁷.

These economic boom aspects have provided Abu Dhabi with the justification for laying foundation for sustainable economy. However, there are additional structural adjustments that Abu Dhabi must implement to make this goal realistic. It is clear that the current economic boom in the UAE has close ties with oil and gas price fluctuations. This implies that the economy of UAE can be destabilized at the slightest price volatilities in the market. Consequently, the UAE has been seeking to stabilize the economy by divesting to non-oil areas to cushion against the volatile market tendencies. Additionally, the Abu Dhabi government has been advocating for increased productivity to ensure that the economy stay competitive¹³⁸.

For the last half century, the Abu Dhabi economy was dependent on oil sector. This trend prevailed until the year 2002- 2005, when the Abu Dhabi Real GDP growth of 12%, ranked high compared to other nations. The Real GDP growth for UAE over the same period was 10% and ranked 10th globally¹³⁹. By 2007, Abu Dhabi has the sixth biggest oil reserve globally estimated at about 98 billion barrels and this placed it at the 10 biggest oil producers with capacity of 2.5 million barrels per day. Abu Dhabi channeled most of this crude oil to the export markets. Overall, the UAE could have earned nearly \$ 90 billion annually at the prevailing crude prices¹⁴⁰.

Abu Dhabi has been investing significant resources earned from oil revenue in areas such as infrastructure and services. Even though the rapid population growth at Abu Dhabi from the international immigrants and new births has been slowing the economic growth of Abu Dhabi, the GDP has nevertheless made significant progress. Due to these

¹³⁷ The Abu Dhabi Economic Vision 2030, p. 24.

¹³⁸ The Abu Dhabi Economic Vision 2030, Ibid.

¹³⁹ The Abu Dhabi Economic Vision 2030, Ibid.

¹⁴⁰ The Abu Dhabi Economic Vision 2030, p. 26

economic developments, the Abu Dhabi populations are wealthier as compared to other emirates of places in the world. A survey of 178 nations places the HDI of UAE 30th globally considering the developments such as higher life expectancy, access to education, literacy levels and consumer buying power¹⁴¹.

Research shows that Abu Dhabi has one of the highest oil price volatility rates compared to the real GDP expansions globally and regionally. This trend slowed down in recent times compares to the year 2005 when volatility rose to 31%. The mean volatility in from 2005 – 2014 was about 8% and this was still strong enough to worry different economic sector planners. Even though Abu Dhabi is basking in high economic growth season¹⁴², analysts cannot assure that the success of one year will be replicated in the successive year.

The strategy of diversifying to other economic sectors other than oil is one sure way of curtailing the oil price volatilities and shocks. Some of the sectors that Abu Dhabi diversifies its economic growth include mining, energy and quarrying. These activities are interrelated with the oil and gas exploration activities. These activities contributed to about 59% of the GDP in 2005. However, as the international crude oil prices improved, Abu Dhabi seemed to be sliding back to rely on them for economic growth¹⁴³

The job opportunities in Abu Dhabi are dominated by the construction industry and government employment at more than 50% combined. Another 13% of the jobs is scattered in the trade, hospitality and livestock sectors, which has shown great potential for growth in the last decade, as shown in the following figure¹⁴⁴.

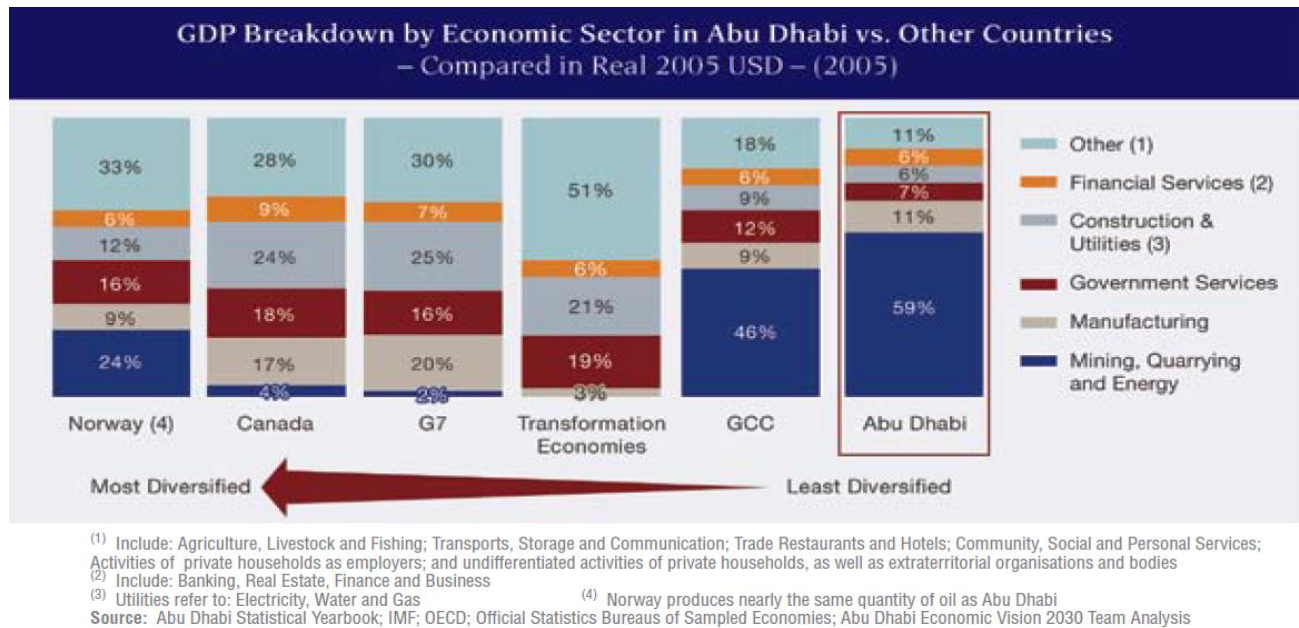
¹⁴¹ The Abu Dhabi Economic Vision 2030, Ibid.

¹⁴² The Abu Dhabi Economic Vision 2030, Ibid.

¹⁴³ The Abu Dhabi Economic Vision 2030, p. 27.

¹⁴⁴ The Abu Dhabi Economic Vision 2030, p. 28.

Figure 11: Abu Dhabi Non-Oil Diversification Sectors



Source: *The Abu Dhabi Economic Vision 2030*, P.28

Research shows that nations with more economic diversity are more stable as compared to those with over concentrated sectors like oil. Abu Dhabi has learnt this lesson and has been venturing into export businesses. The process has not been smooth so far because significant number of economic sectors is affected with the oil price volatility. Whenever the international crude oil prices are booming, Abu Dhabi is able of cushioning the rest of economic sectors from inflation. The reverse happens when the oil prices fluctuate. The strategy adopted by Abu Dhabi towards economic sustainability is to widen the pyramid base of the non- oil sectors rather than decrease the oil production. Consequently, Abu Dhabi has been welcoming foreign direct and local investments into their economy¹⁴⁵.

Abu Dhabi has also resolved to maintain high oil production to the global market so that the prices can stabilize because any volatility will normally trickle back to the economy. As the oil and gas sectors continue to drive the Abu Dhabi economy, it is projected these will account for nearly 64% of the GDP. Investors in other sectors of the economy are expected to close in the gaps and diversify the Abu Dhabi economy for

¹⁴⁵ The Abu Dhabi Economic Vision 2030, p. 29.

better sustainability¹⁴⁶. In Abu Dhabi, a survey in 2005 indicated that 21% of jobs were created by the micro enterprises, 15.5% in the small enterprises, 12.1% in the medium enterprises and 50.9% in the large enterprises. These data indicate that the private sectors are becoming economically important in the Abu Dhabi economic growth. In fact, the Abu Dhabi private sectors have been enhancing their productivity as a strategy of remaining economically viable and sustainable. The SMEs are also champions of innovations to provide their markets with variety of products and services¹⁴⁷. Abu Dhabi has also been pursuing some hybrid strategies of making economy sustainable.

- Immediate Objective: Ensure A Balanced Social and Regional Economic Development Approach That Brings Benefits to All

Due to the rapid development of the Abu Dhabi economy, the leadership always seeks a balanced social and regional developmental agenda for all parties. The increasing UAE population is putting pressure on the economic growth because services are demanded concurrently. Alternatively, the rapidly growing Abu Dhabi population offers new supply of labor to expand the economy further as long as the government can train them with appropriate skills. Abu Dhabi has been keeping track of the economic developments to ensure a balance achieves especially between the local and international expatriates¹⁴⁸. By 2005, Abu Dhabi had about 1.4 million people of which 75% were expatriates and 25% locals¹⁴⁹.

According to Abu Dhabi census of 2005, the males were 50.5% and females 49.5% of the entire population. The elderly above the 65 years active working age were 2.2%. The active working age from 15 – 65 years were 58%, while the children below 15 years were 39.4%. This census indicated that the women in Abu Dhabi were not adequately engaged in economic activities like the male counterparts. Therefore, the Abu Dhabi government sought a more balanced strategy of labor allocation so that the women too can increase the rate of economic growth¹⁵⁰. On a global scale, Abu Dhabi only 18.5% of the Abu Dhabi women were active in employment compared to 22% in Egypt, 30% in Lebanon and 28%

¹⁴⁶ The Abu Dhabi Economic Vision 2030, p. 30.

¹⁴⁷ The Abu Dhabi Economic Vision 2030, p. 31.

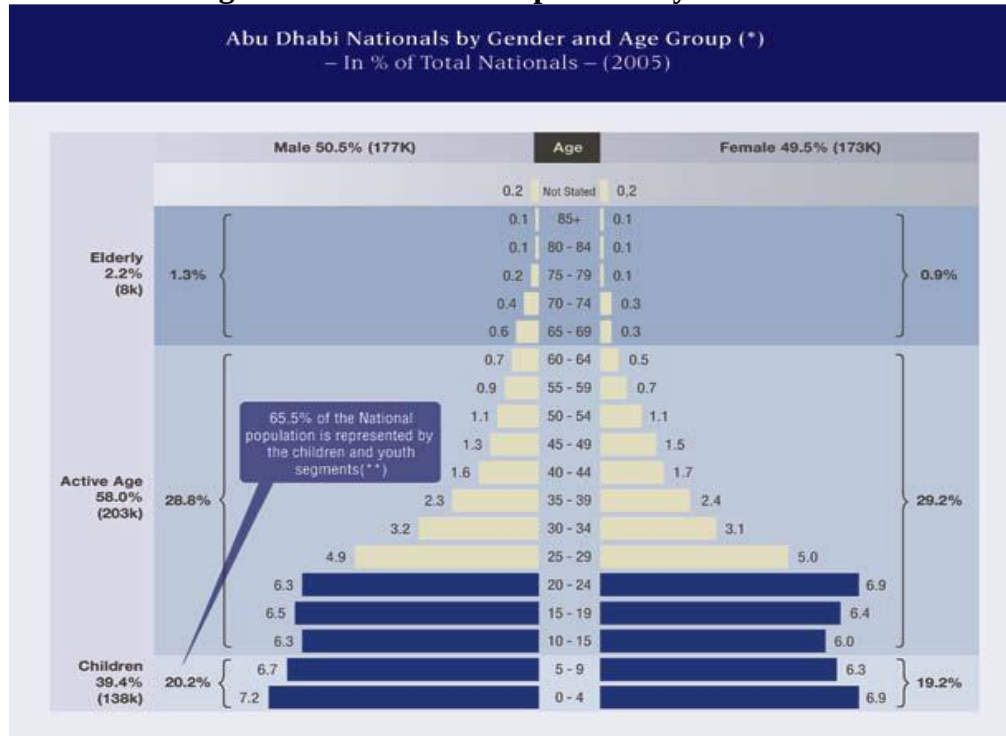
¹⁴⁸ The Abu Dhabi Economic Vision 2030, p. 35.

¹⁴⁹ Abu Dhabi Census 2005.

¹⁵⁰ Abu Dhabi Census 2005.

in MENA. By 2005, Norway had one of the highest female workforce participation globally at 47%¹⁵¹. The following figure illustrates the Abu Dhabi workforce balance by gender.

Figure 12: Abu Dhabi Population by Gender



Source: The Abu Dhabi Economic Vision 2030, p. 36.

The clamor to empower women must adopt a systematic approach even though the 2005 census shows that Abu Dhabi at 18.5% was ahead of Saudi Arabia at 15% and UAE 13%¹⁵². The rationale behind involving more women into the Abu Dhabi workforce is to increase productivity and reduce dependency ratio. Furthermore, engaging more Abu Dhabi women in the workforce will minimize the demand for expatriates and increases the household earnings that previously depended on the male as main breadwinners. About 50% of the household in Abu Dhabi earned over AED 10,000 in 2005, and this was distributed by 6.5 persons per house¹⁵³.

Abu Dhabi has been striving to balance between the local and international labour resources to meet the demand for skilled and unskilled labor. This trend has seen

¹⁵¹ The Abu Dhabi Economic Vision 2030, p. 36.

¹⁵² The Abu Dhabi Economic Vision 2030, p. 37.

¹⁵³ The Abu Dhabi Economic Vision 2030, p. 38.

migrants streaming into Abu Dhabi under different types of contracts to address the varied work challenges. It is evident that the highly skilled expatriates in Abu Dhabi are satisfied by the living standards and work terms other than the opportunities for cultural mixes. Abu Dhabi also attracts excellent tourist who get the desired standards of services from the highly skilled expatriates and local workers¹⁵⁴.

4.4 Objectives of the Abu Dhabi Economic Vision 2030

The following figure illustrates the objectives of Economic Vision 2030. The economic prosperity of Abu Dhabi tends to have a multiplier effect to the rest of UAE and this is a wider objective of the Economic Vision 2030. Other than the economic success positioning Abu Dhabi as an attractive destination for the most skilled labor, various professionals in areas like education, health, transport and communication among others have been attracted and retained. Eventually, the economic success of Abu Dhabi will be replicated to other areas of the UAE¹⁵⁵. The following figure illustrates the Abu Dhabi Economic Vision 2030 for the rest of the objective 4, 5, 6 and 7.

¹⁵⁴ The Abu Dhabi Economic Vision 2030, p. 40.

¹⁵⁵ The Abu Dhabi Economic Vision 2030, p. 40.

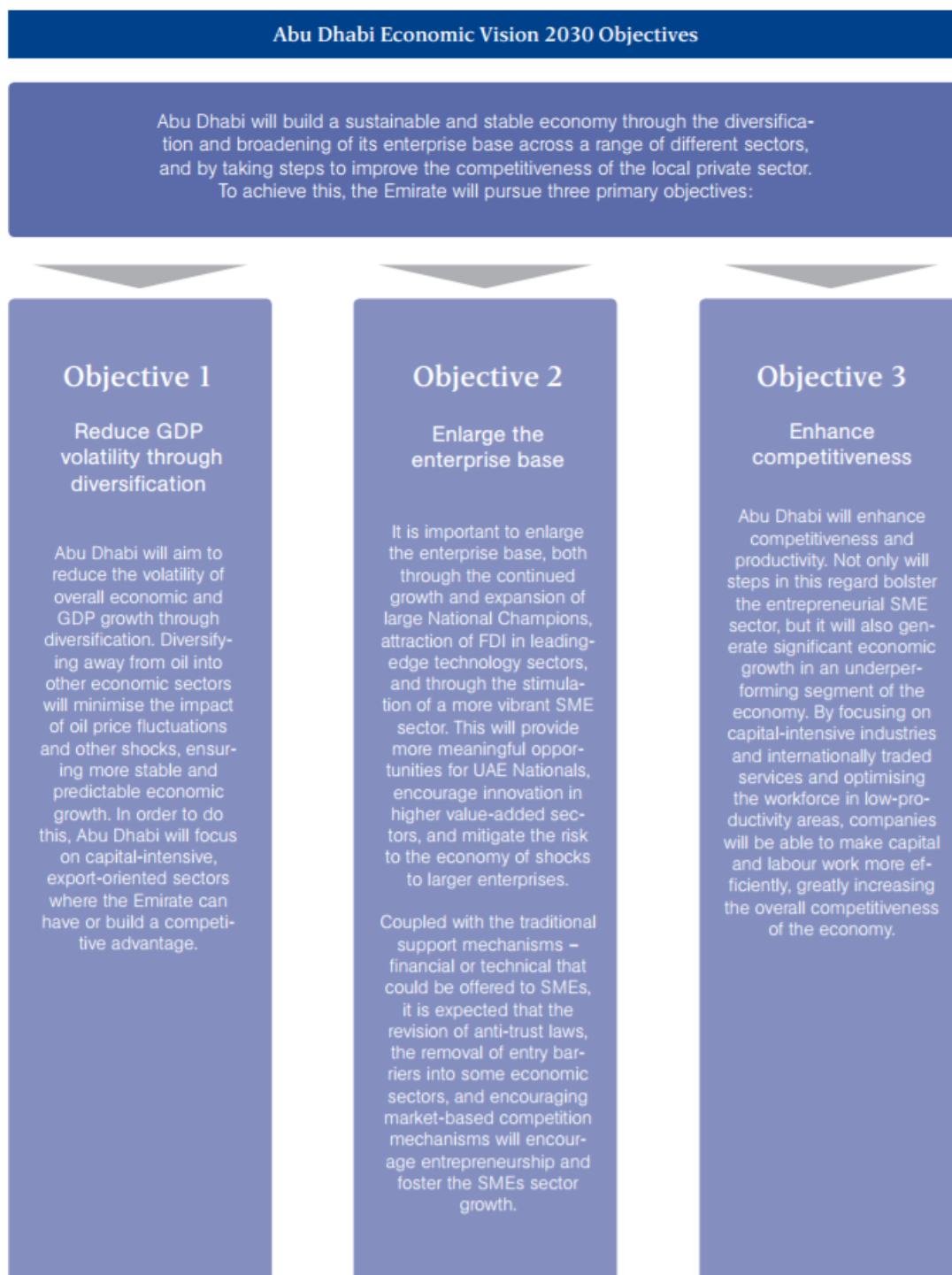
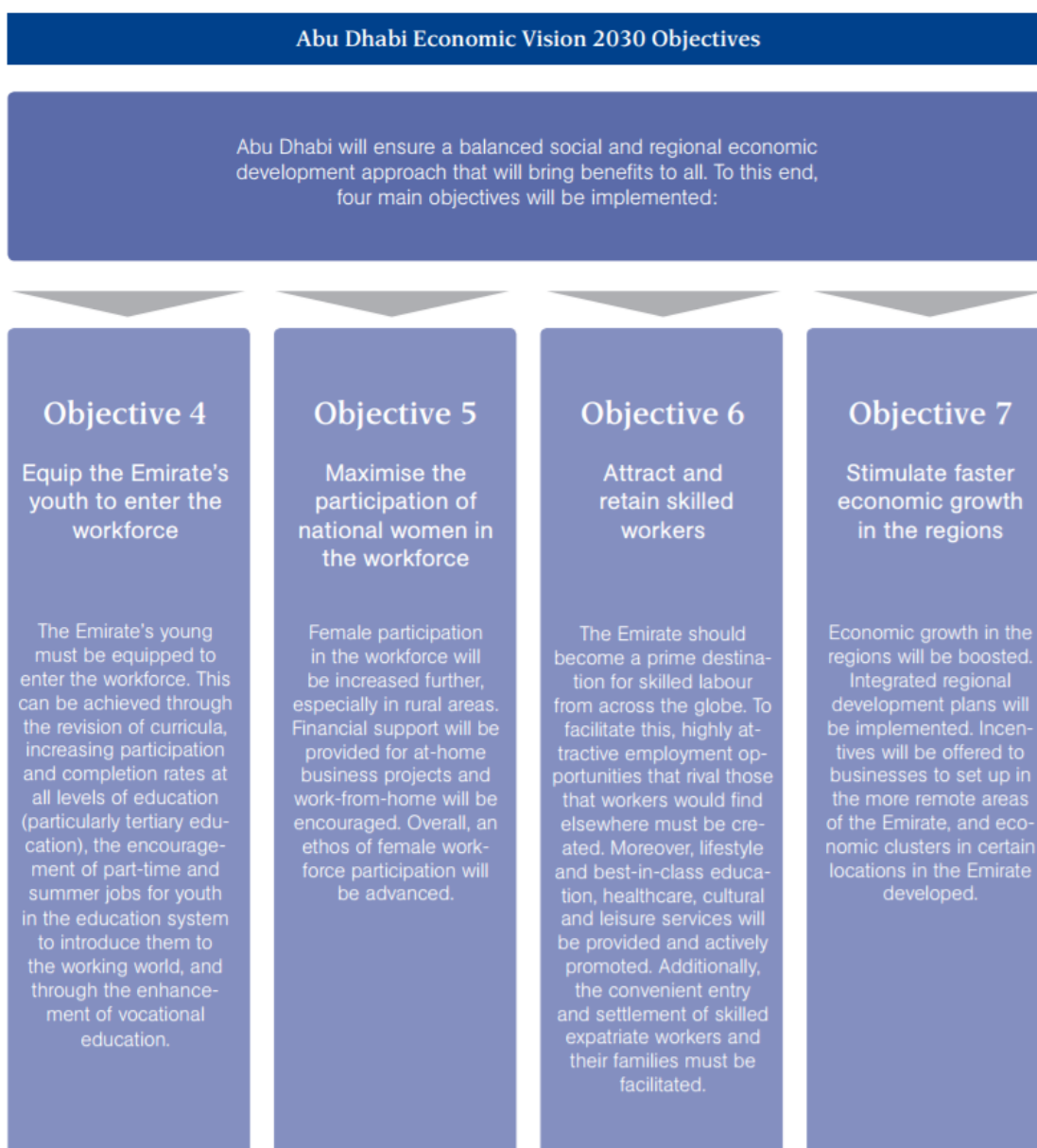
Figure 13: Abu Dhabi Economic Vision 2030 Objectives

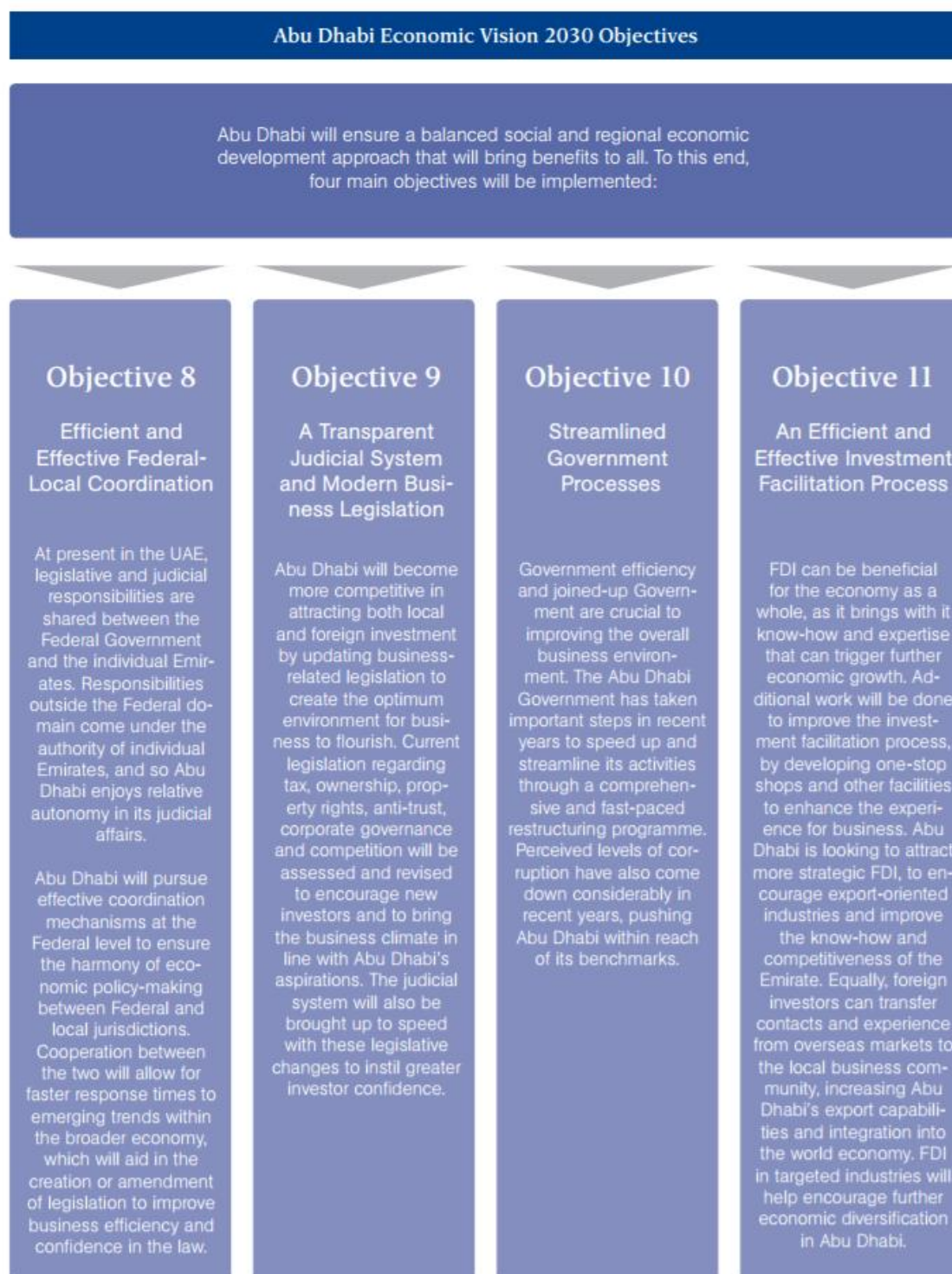
Figure 14: Abu Dhabi Economic Vision 2030 Objectives 4, 5, 6 & 7.

Source: *The Abu Dhabi Economic Vision 2030*, p. 41.

Abu Dhabi Vision 2030 is guided by seven principles. The first principle¹⁵⁶ is to “Build an Open, Efficient, Effective and Globally Integrated Business Environment”. The following figure shows the main objectives for this first principle. Figure 15: Abu Dhabi Economic Vision 2030 Objectives 8, 9, 10 & 11.

¹⁵⁶ The Abu Dhabi Economic Vision 2030, p. 46.

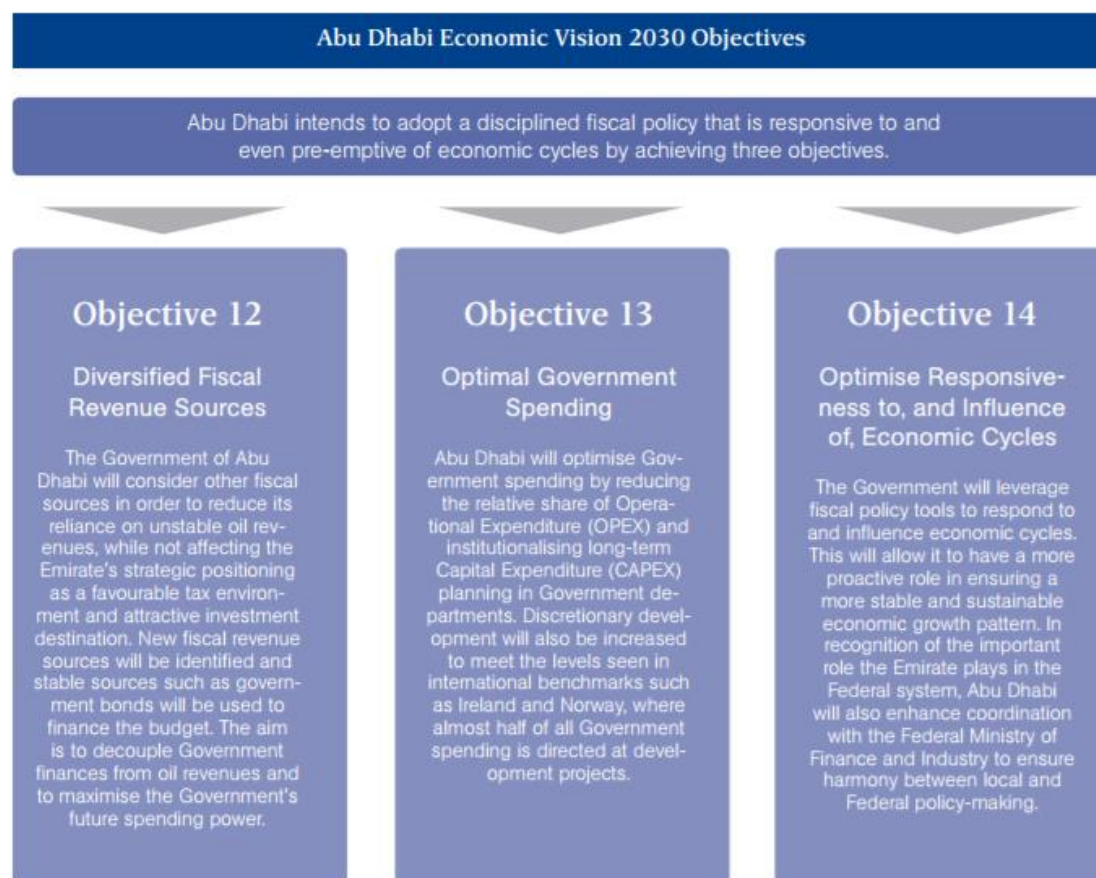
Figure 15: Abu Dhabi Economic Vision 2030 Objectives 8,9,10&11



Source: *The Abu Dhabi Economic Vision 2030*, p. 55

The second principle is “Adopting Disciplined Fiscal Policies that are Responsive to Economic Cycles”¹⁵⁷. The following figure demonstrates the objectives for achieving the second principle.

Figure 16: Abu Dhabi Economic Vision 2030 Objectives 12, 13 & 14



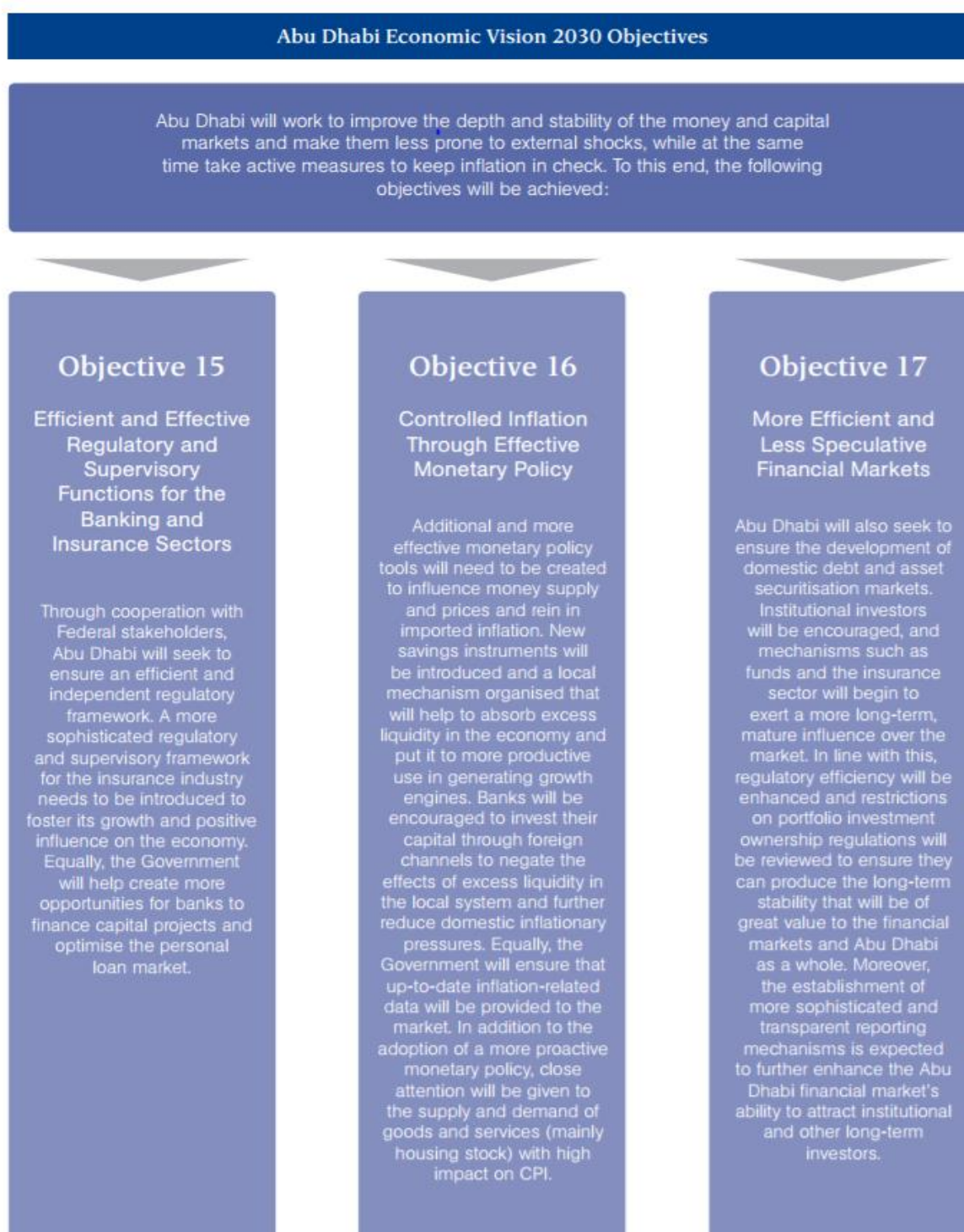
Source: *The Abu Dhabi Economic Vision 2030*, p. 61.

The third principle is to “Establish a Resilient Monetary and Financial Market Environment with Manageable Levels of Inflation”¹⁵⁸. The following figure clarifies the objectives of the third principle.

¹⁵⁷ The Abu Dhabi Economic Vision 2030, p. 56.

¹⁵⁸ The Abu Dhabi Economic Vision 2030, p. 62.

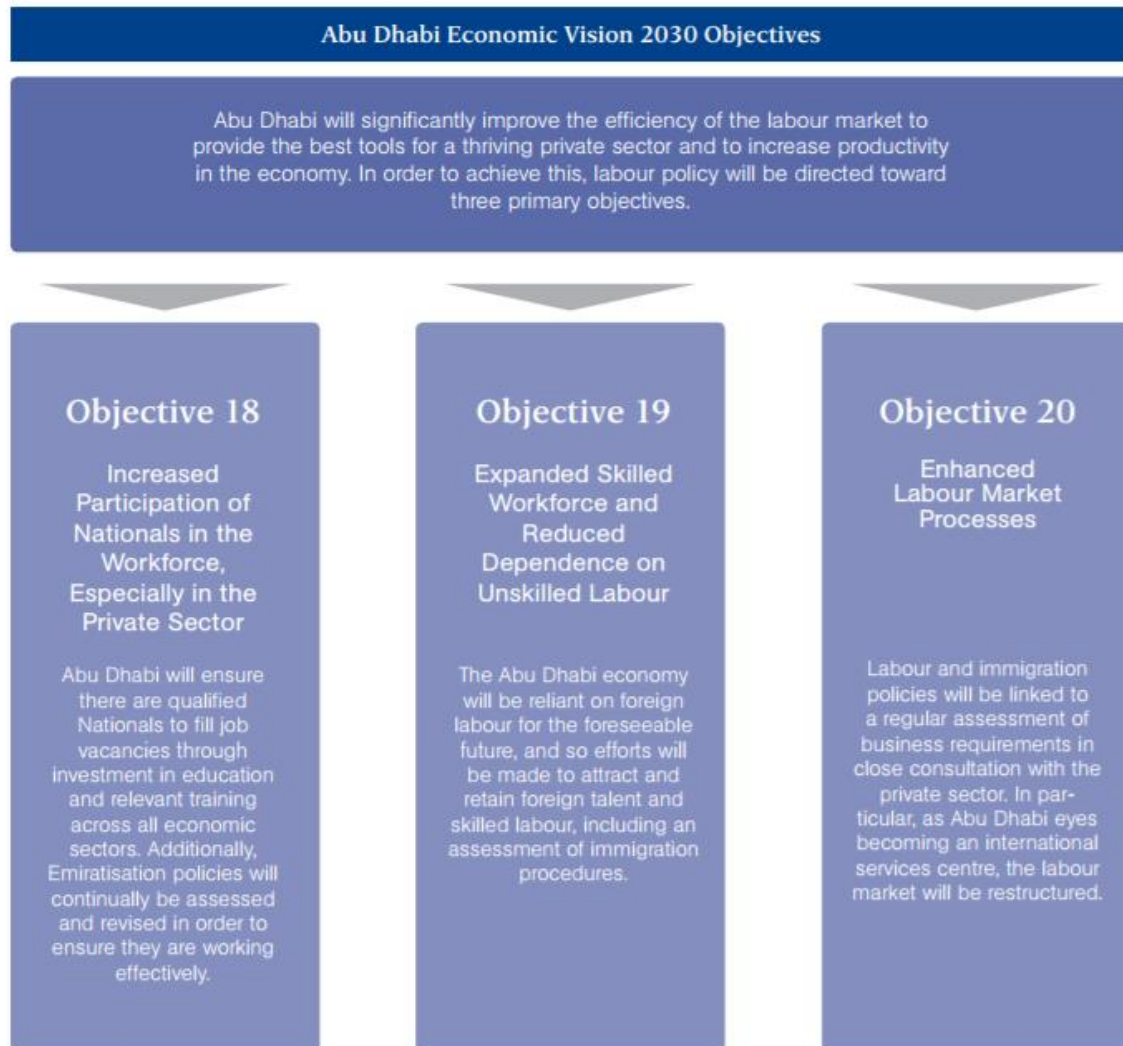
Figure 17: Abu Dhabi Vision 2030 Objectives 15, 16 & 17.



FSource: The Abu Dhabi Economic Vision 2030, p. 72.

The fourth principle is to “Drive Significant Improvement in the Efficiency of the Labour Market”¹⁵⁹. The following figure elaborates the objectives of the fourth principle

Figure 18: Abu Dhabi Economic Vision 2030 Objectives 18, 19 and 20



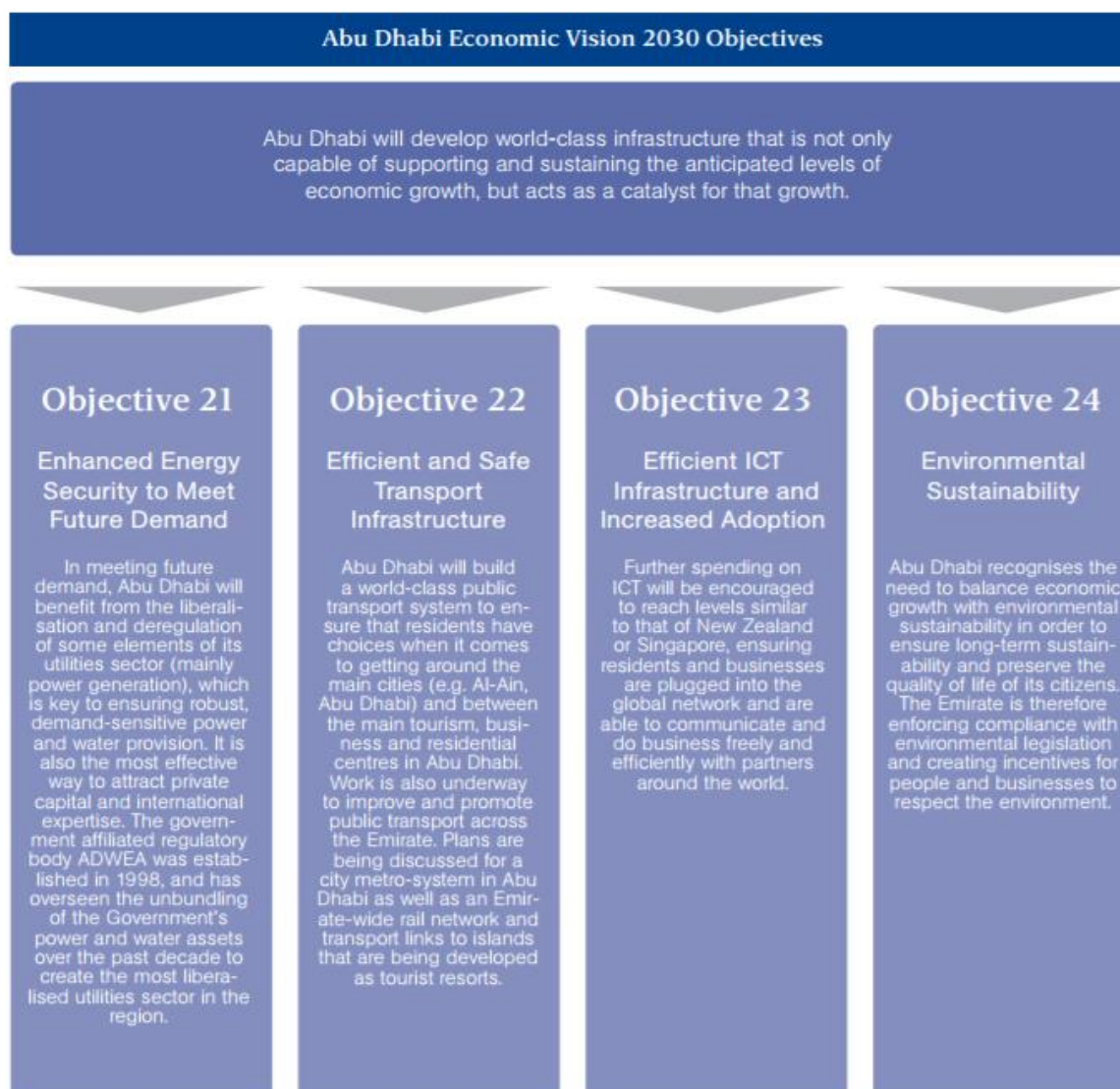
Source: The Abu Dhabi Economic Vision 2030, p. 77.

The fifth principle is to “Develop a Sufficient and Resilient Infrastructure Capable of Supporting Anticipated Economic Growth”¹⁶⁰. The following figure illustrates the specific objectives of the fifth principle.

¹⁵⁹ The Abu Dhabi Economic Vision 2030, p. 73.

¹⁶⁰ The Abu Dhabi Economic Vision 2030, p. 78.

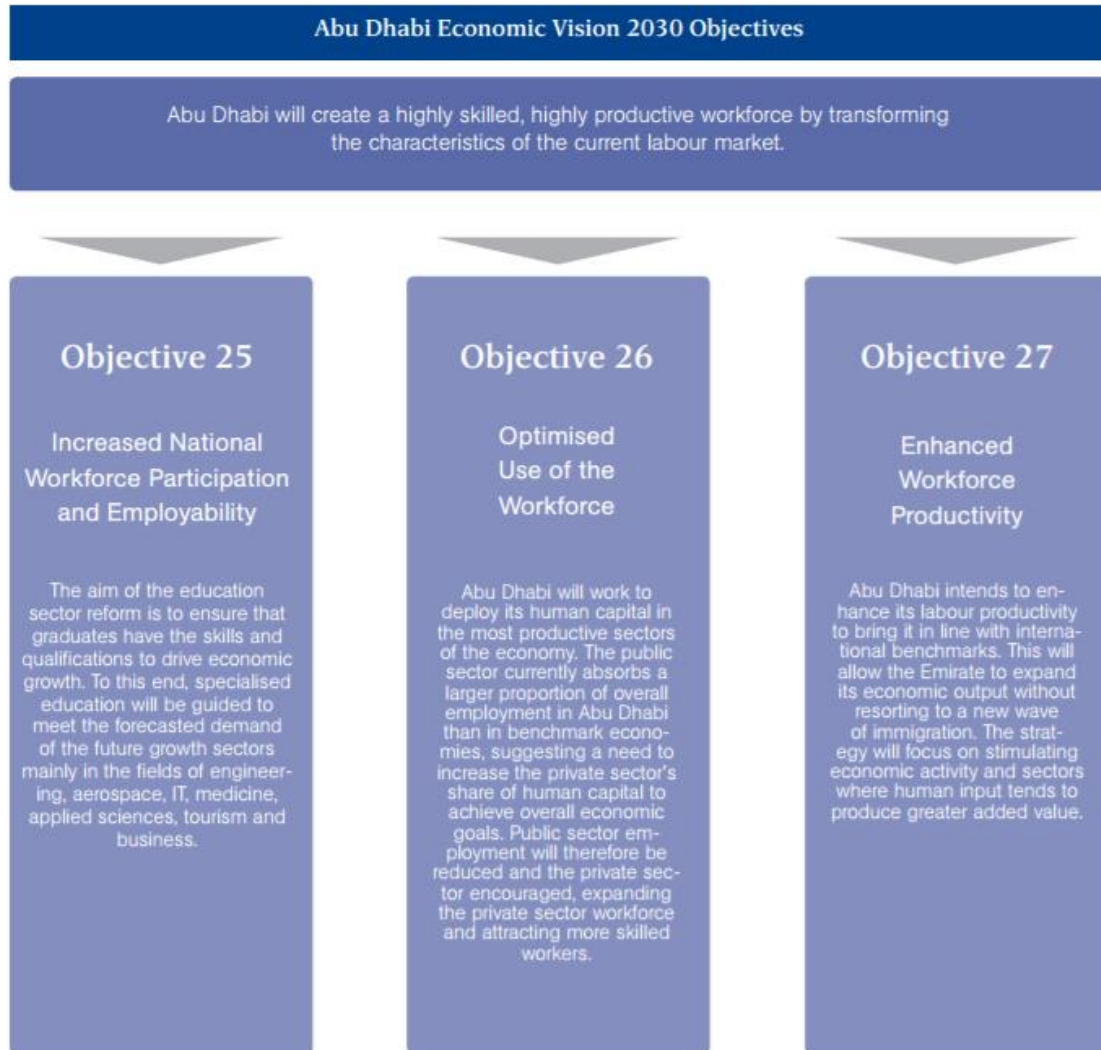
Figure 19: Abu Dhabi Economic Vision 2030 Objectives 21, 22, 23 & 24



Source: *The Abu Dhabi Economic Vision 2030*, p. 90.

The sixth principle is “Developing a Highly Skilled, Highly Productive Workforce”¹⁶¹.

Figure 20: Abu Dhabi Economic Vision 2030 Objective 25, 26 & 27



Source: *The Abu Dhabi Economic Vision 2030*, p. 99.

The seventh principle is to “Enable Financial Markets to Become the Key Financiers of Economic Sectors and Projects”¹⁶². The following figure illustrates the objectives of the final principle.

¹⁶¹ The Abu Dhabi Economic Vision 2030, p. 91.

¹⁶² The Abu Dhabi Economic Vision 2030, p. 100.

Figure 21: Abu Dhabi Economic Vision 2030 Objectives 28, 29 & 30

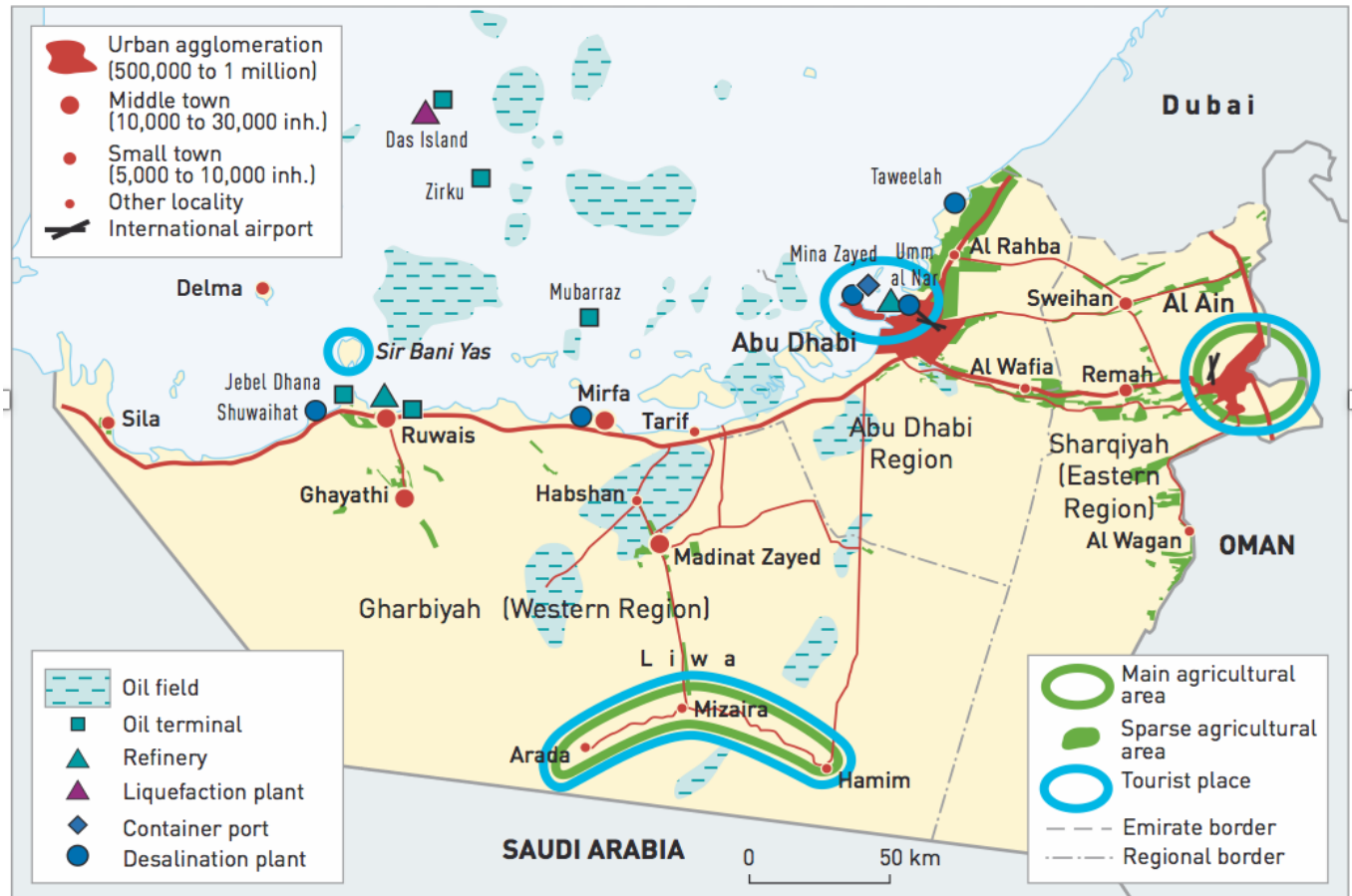
Source: *The Abu Dhabi Economic Vision 2030*, p. 109.

4.5 UAE in the Context of Disaster

The country's geographical location around the Arabian Plate between the Iranian plateau and the Zagros Fault exposes to various natural disasters. This region has a history of seismic movements as evident from the documentation. Additionally, the population of the UAE has been growing rapidly, and the pressure for settlement areas is leading people to migrate to places deemed prone to natural disasters. Therefore, the UAE has increasingly become exposed to the same hazards. Further, UAE is the most industrialized country in the Middle East next only to Saudi Arabia. Major industrial complexes dot the skyline of Abu Dhabi and Dubai emirates. As a result, UAE has become prone to industrial disasters also. In Chapter 5, the various factors – social, cultural, economic, demographic and political - that make UAE vulnerable to disasters are discussed in details.

CHAPTER 5: GEOGRAPHY AND VULNERABILITY TO DISASTERS IN THE UAE AND ABU DHABI

Figure 22 (A): UAE Vulnerability Map



Source; Ph. Cadene, B. Dumortier, 2013, Atlas of the Gulf States, Leiden-Boston, Brill, p.66

5.1 Sociology and Literacy Levels for Understanding Vulnerability to Disasters

The sociological state of the UAE can be analyzed using the Daniel Lerner's modernization theory¹⁶³. Even though this model has been faulted for being out of touch with latest development, it nevertheless offers a foundation for understanding how societies and cultures transform using a 117-item questionnaire. By 2008, the UAE has 11.3% illiteracy levels. This was higher than its GCC counterparts like Kuwait at 11%; Qatar at 6.7%. However, when comparing with other large Muslim population countries,

¹⁶³ Lerner, D. *The passing of traditional society: modernizing Middle East*, Free Press of Glencoe, New York, 1958.

Bahrain was worse at 13.5%, Egypt at 28.6%, India at 39% and Indonesia at 9.6%¹⁶⁴. The UAE population has high media penetration and internet usage. Some of the major media channels that operate in the UAE include Fox, Al-Jazeera and other digital global networks¹⁶⁵.

In terms of social change in the UAE, there has an ambitious plan to modernize the nation hedging on the multi-cultural background of the population. However, the fast pace of modernization in the UAE has various challenges that the leaders would like addressed so that the country does not lose its national values as espoused by the founding father Sheikh Zayed Bin Sultan Al-Nahyan¹⁶⁶.

5.2 Culture of UAE People and Their Understanding of Types of Disasters

The physical location of the UAE has implications that the population is multi-cultural. Some of the major cultural mixes found in the UAE are Indian, Pakistan, Bangladesh, Iran, Jordan, Philippines, Sri Lanka and Nepal among others¹⁶⁷. The UAE prospects for globalization have greatly varied the people's culture. Essentially, the foreigners from different nations have the capacity of shaping the people's culture because they migrate to the UAE with their own languages and ethnicities. As these multinational backgrounds interact, some local culture is overlooked while new ones are learnt. For instance, it is common to find restaurants in the UAE that specialize in Indian foods according to the different festive seasons. Similarly, the Christian cultures are also very pervasive in the UAE with popular seasons like Christmas and Easter celebrated by the masses. Overall, the UAE government has been very tolerant to other cultures and there is evidence of many Christian churches and Hindu temples dotting the nation¹⁶⁸.

The UAE culture is further shaped by the influx of international tourists who are attracted to some popular destinations such as the Saadiyat Island. This site alone rakes in more than \$30 billion every year due to the prominent visitors from the versatile architectural and artistic features. The Saadiyat Island was recently expanded to cover 2,700 hectares to cover the Emirati culture in depth and demonstrate that the nation is

¹⁶⁴ Khondker, p. 2.

¹⁶⁵ Khondker, p. 2-3.

¹⁶⁶ Khondker, p. 3.

¹⁶⁷ Khondker, p. 6.

¹⁶⁸ Khondker, p. 5.

opening up to international tourism. The theme of the Saadiyat Island is a blend of modern and ancient experiences to display the new Emirati culture¹⁶⁹.

The UAE has a characteristic religious faith embedded on Islam, which actually dictates how the Emiratis run their lives. The UAE citizens, who are largely Muslims, follow the Quran teachings on five pillars of Islam. Therefore, the culture is one of submission to the almighty and the same practice is passed down from one generation to the next. Generally, the UAE prefer leaders who gather views of the people so that decisions are arrived from consensus. Therefore, the UAE has a stable leadership culture over the years¹⁷⁰.

The Bedouins culture is also very prominent in the UAE, following the earlier Arab population that dominated most of the towns and business centers. The Bedouins were predominantly nomadic culture and were known for their love of trade on livestock, hunting and search for water. The Bedouin culture also embraces consultative leadership and the modern day population in the UAE via Islamic teachings has inherited this. Additionally, the Bedouins culture of hospitality and kindness is perhaps one of the modern reasons why people have been migrating to the UAE from other areas of the world. The Bedouins are generous in providing food and housing for visitors irrespective of the financial positions¹⁷¹.

The UAE has a collectivist culture where a lot of emphasis is on family and faith. Therefore during the first interaction, it is common for a conversation about visitors background to feature including their occupation. The UAE people rationalize the family cohesion as a step towards knowing persons individually. Additionally, all youths are expected to stay with their families before the arranged marriages take place. As the people adopt a submissive culture towards God, they should also demonstrate a Muslim identity¹⁷².

Most of the UAE roles are closely defined around gender orientation as a cultural practice in the region. Even though there has been some significant gender tolerance in

¹⁶⁹ Khondker, p. 7.

¹⁷⁰ Riel, B. *The Cultural Context – United Arab Emirates*, Eaton Consulting Group Newsletter, 2000, p. 1
Retrieved <http://www.bobriel.com/pdf%20files/cultural%20context%20-%20uae.pdf>

¹⁷¹ Riel, 2000, p. 2.

¹⁷² Ibid

the recent decades, the males still dominate most of the office or professional jobs while the female have support or subordinate roles. Therefore, the UAE culture impresses upon men to pursue higher education and be ready to support their women who could choose to stay at home and raise the family. Lately, the females have been given more roles in homes and mothers are respected according to Arab culture. The males are the symbol of authority on most homes in the UAE¹⁷³.

The UAE's cultural view of time is continuous and in cycles as compared to the Western culture which is linear and segmented according to goals. Therefore, the UAE culture is more relaxed and is long term oriented compared to Western time culture, which is immediate. The UAE culture is also very conservative of the past while Western culture is exploratory in approach. The UAE embrace a polychronic culture, whereby, they condone many natural events taking place at once or individually. The population is not bothered by time and hence punctuality can be an issue of concern during meeting with other foreigners. Furthermore, the UAE hosts in meetings tend to multi task such as receiving calls or walking to adjacent rooms for different reasons. Collective meetings often have numerous agendas even though few are closed due to time constraints. In the contrary, the Western world is monochronic in culture and punctuality is paramount¹⁷⁴.

The UAE Arabs believe in fatalisms, that is, they surrender to the impact of the environment rather than attempt to manipulate it¹⁷⁵. Consequently, there is a culture of belief that however much man accomplishes planning, nature will still prevail fatefully. This fatalistic culture is common among Islamic society where events are related to the will of God, hence, the common quote "Inshallah." Therefore, any person coming across as attempting to alter the course of nature is regarded as blasphemous.

The final aspect of the UAE culture is the communication style. Generally, the population is inclined to cordial relationship to effect communication. Consequently, both private and social matters are communicated among the population. It is common for UAE people to precede a personal communication with a person after satisfaction with the business interaction. During such period, the people could exchange some gifts to

¹⁷³ Ibid

¹⁷⁴ Riel, 2000, p. 3.

¹⁷⁵ Riel, 2000, p. 3

foster the relationship. The UAE Arabs emphasize on the communication content rather than on the media of communication or even the intentions¹⁷⁶.

The communication tradition is to avoid offensive utterances as much as possible. Politeness is the underlying virtue that the UAE population endeavors to achieve culturally and it is common practice to treat any guest with utmost courtesy. Moreover, the desire to communicate eloquently is a culture that the people of UAE cherish. The value placed on choice of words is seen on expressions of themselves in sentences. Most UAE Arabs are very animated while talking aloud. The emotional a person is during communication, the higher the chances of belief in their message. In the UAE, the more knowledge about a person communicating, the more engagement the business can expect. Moreover, if a member of a business group has been engaged previously, the same is assumed about their partners in future communication¹⁷⁷.

5.3 Population and Vulnerability to Different Types of Disasters

The UAE's multinational population is mainly driven by migrant job vacancies targeting the infrastructural, manufacturing and service sectors of the economy. There is no doubt that the UAE has one of the biggest migrant to citizen population ratio globally. By 2008, about 80% of the entire population in UAE was migrant laborers. Hence, the fast speed of economic growth of the UAE economy is justified by this migrant labor force presence. Most of these migrants are employed in the petroleum and construction industries, which are among the most active GDP contributors. A look at the population composition of the UAE indicates that the nation has been keen on cosmopolitan structures where people from all over the world converge irrespective of their economic, educational and class backgrounds¹⁷⁸. The population of the UAE has been increasing steadily from 1 million in 1980 and projected to reach 15.5 million by 2050¹⁷⁹. The following table illustrates the UAE population trend¹⁸⁰.

¹⁷⁶ Riel, 2000, p. 3

¹⁷⁷ Riel, 2000, p.3-4.

¹⁷⁸ Khondker, p. 6

¹⁷⁹ ESCWA, *The Demographic Profile of the United Arab Emirates*. 2013, p.1, Retrieved <http://www.escwa.un.org/popin/members/uae.pdf>

¹⁸⁰ United Nations, *World Population Prospects: The 2012 Revision*, Retrieved http://esa.un.org/unpd/wpp/unpp/panel_indicators.htm

Table 8: Population Trend of the UAE by Genders

Population size (thousands)			
Year	Male	Female	Total
1980	707	308	1,015
1985	874	473	1,347
1990	1,185	622	1,806
1995	1,561	786	2,346
2000	2,042	984	3,026
2005	2,822	1,327	4,149
2010	5,960	2,482	8,442
2015*	6,659	2,918	9,577
2020*	7,299	3,303	10,602
2025*	7,851	3,628	11,479
2030*	8,385	3,946	12,330
2035*	8,918	4,283	13,201
2040*	9,433	4,631	14,064
2045*	9,885	4,957	14,842
2050*	10,239	5,240	15,479

Source: United Nations, World Population Prospects: The 2012 Revision

In the most recent decades, the highest population growth rate recorded in the UAE was from 2005 to 2010 at 14.21%. Prior to that period, the growth rate fluctuated from 5.67% in 1980 to 6.31% in 2005. The growth rate slowed down from 2010 - 2015 at 2.52% and is projected to drop further to 0.84% by 2050¹⁸¹. The following table illustrates these trends.

¹⁸¹ United Nations, World Population Prospects, Ibid.

Table 9: UAE Population Growth Rates

Period	Population Growth Rate (%)
1980-1985	5.67
1985-1990	5.87
1990-1995	5.23
1995-2000	5.09
2000-2005	6.31
2005-2010	14.21
2010-2015*	2.52
2015-2020*	2.03
2020-2025*	1.59
2025-2030*	1.43
2030-2035*	1.36
2035-2040*	1.27
2040-2045*	1.08
2045-2050*	0.84

Source: United Nations, World Population Prospects: The 2012 Revision

The life expectancy of the UAE population has been improving over time. From 1980 – 1985 to the 2005 – 2010 period, the life expectancy increased by 7.2 years, from 68.7 years to 75.9 years. By 2045 – 2050, the life expectancy could hit 82.7 years. The high infant mortality rate of 29.6 per 1000 live births in 1980 to 1985 reduced to 6.9 deaths during the 2005 to 2010 period. The infant mortality rates are expected to reduce to 2.4 deaths per 1000 live births by 2045 – 2050 period. The mortality of children under five years was 14 deaths / 1000 live births from 1995 – 2000 period. This statistic dropped to 8 deaths by 2010 and is projected to be 3 deaths from 2040 to 2050¹⁸².

The UAE maternal mortality was 24 deaths for every 100,000 live births during the 1990s. However, this statistic dropped to 12 deaths by 2010¹⁸³. The UAE fertility rate decreased from 5.23 children per woman in 1980 – 1985 to 2.40 children during 2000 – 2005 and further to 1.97 children from 2005 – 2010. Therefore, the UN projects that fertility rate could drop to 1.60 children before a slight increment at 1.64 children by

¹⁸² United Nations, *World Population Prospects*, Ibid

¹⁸³ World Health Statistics, 2012. Retrieved http://www.who.int/gho/maternal_health/countries/en/#U

2045 – 2050¹⁸⁴. The penetration of contraceptive in the UAE for youths and adult women from 15 – 49 years old was 45.7% by 2010 and 47.5% by 2012. This figure is projected to rise to 50.3% by 2015¹⁸⁵.

The UAE population experiences two types of migrations, internal and international. The rate of rural to urban migration from 1980 – 1995 reduced from 80.7% - 78.3%. This figure later rose to 84.0% in 2010 following growing demand for labor in the job openings. The internal migrations are projected to hit 90.6% by 2050 as shown in the table below¹⁸⁶.

¹⁸⁴ United Nations, *World Population Prospects*, Ibid

¹⁸⁵ United Nations, World Contraceptive Use, 2012, Retrieved,
<http://www.un.org/esa/population/publications/WCU2012/MainFrame.html>

¹⁸⁶ United Nations, World Urbanization Prospects: the 2011 Revision , Retrieved,
http://esa.un.org/unup/unup/index_panel1.html

Table 10: Rural – Urban Migration Projections in the UAE from 1980 to 2050

Year	Urban (thousands)	Rural (thousands)	Total (thousands)	Percentage Urban (%)	Percentage Rural (%)	Year	Annual Rate of Change of Urban (%)	Annual Rate of Change of Percentage Rural (%)
1980	820	196	1,016	80.7	19.3	1980-1985	-0.23	0.92
1985	1,077	272	1,349	79.8	20.2	1985-1990	-0.19	0.73
1990	1,430	379	1,809	79.1	20.9	1990-1995	-0.19	0.69
1995	1,839	509	2,349	78.3	21.7	1995-2000	0.48	-1.85
2000	2,434	600	3,033	80.2	19.8	2000-2005	0.50	-2.16
2005	3,348	722	4,069	82.3	17.7	2005-2010	0.43	-2.11
2010	6,313	1,199	7,512	84.0	16.0	2010-2015*	0.34	-1.90
2015*	7,159	1,215	8,374	85.5	14.5	2015-2020*	0.27	-1.67
2020*	7,950	1,224	9,174	86.7	13.3	2020-2025*	0.21	-1.43
2025*	8,641	1,226	9,867	87.6	12.4	2025-2030*	0.16	-1.19
2030*	9,261	1,228	10,489	88.3	11.7	2030-2035*	0.14	-1.09
2035*	9,817	1,224	11,042	88.9	11.1	2035-2040*	0.13	-1.09
2040*	10,309	1,209	11,518	89.5	10.5	2040-2045*	0.13	-1.10
2045*	10,714	1,182	11,896	90.1	9.90	2045-2050*	0.12	-1.11
2050*	11,010	1,142	12,152	90.6	9.40			

Source: United Nations, World Urbanization Prospects: The 2011 Revision

Data for the international migrations into the UAE indicates that about 7.9 million were realized, equivalent to 83.75% of entire country's population. About 75% of these international migrants were males while females were 25% for year 2013. The growth of international migrants in UAE for year 1990 – 2000 and 2000 – 2010 rose from 6.27% to 10.95% respectively. The migrant growth rate was expected to decline to 2.25% for the 2010 to 2013 period. With a baseline of every 1000 UAE populations, the net migrant composition was 31.6 for 1990 to 1995 and this rose to 121.1 for 2005 to 2010. This

figure will decline to 6.4 migrants per 1000 UAE population by 2045 – 2050. UN data for net migrations within the UAE from 1980 to 2050 indicates fluctuating outcomes as illustrated in the table below¹⁸⁷:

Table 11: UAE Net Migration Trends 1980 – 2013

Year	Net Migration (Average annual)	
	Rate (Per 1,000 population)	Number (thousands)
1980-1985	29.5	35
1985-1990	32.9	52
1990-1995	31.6	66
1995-2000	34.6	93
2000-2005	48.2	173
2005-2010	121.1	762
2010-2015*	11.4	103
2015-2020*	10.3	104
2020-2025*	8.8	97
2025-2030*	8.1	97
2030-2035*	7.6	97
2035-2040*	7.1	97
2040-2045*	6.7	97
2045-2050*	6.4	97

Source: United Nations, World Population Prospects: The 2012 Revision

The yearly change in migrant populations from 1990 – 2000 was 6.27%; from 2000 – 2010 was 10.95% and from 2010 to 2013 was 2.25%¹⁸⁸. The following table illustrates the international migrant figures for UAE from 1990 to 2013.

¹⁸⁷ United Nations, *World Migration Stock: The 2013 Revision*, Retrieved, <http://esa.un.org/unmigration/migrantstocks2013.htm?mtotals>

¹⁸⁸ United Nations, *World Migration Stock: The 2013 Revision*, Ibid.

Table 12: International Migrant Data for UAE 1990 -2013

Indicator	1990	2000	2010	2013*
Estimated Number of IM at Mid-Year (total)	1,306,574	2,446,675	7,316,611	7,826,981
Estimated Number of IM at Mid-Year (Male)	932,046	1,757,144	5,463,515	5,850,180
Estimated Number of IM at Mid-Year female)	374,528	689,531	1,853,096	1,976,801
Estimated Number of Refugees at Mid-Year	433	562	538	677
IM as Percentage of the population (%)	72.33	80.85	86.67	83.75
Female Migrants as Percentage of all IM (%)	28.66	28.18	25.33	25.26
Refugees as Percentage of IM (%)	0.03	0.02	0.01	0.01

Source: United Nations, World Migration Stock: The 2013 Revision.

Throughout the year 1990, the UAE population below 15 years has been reducing and this trend will prevail towards 2050 as more women use contraceptives. Additionally, the UAE employable age group from 15 – 64 years has been growing in population from 68% in 1990 hitting 85.8% by 2010. There might be a slight growth to 86.2% by 2030 and thereafter a slump is expected. The number of persons aged over 65 years reduced from 1.3% in 1980 to 0.3% by 2010, but this figure could to increase to 24.6% by 2050¹⁸⁹ as shown in the table below:

¹⁸⁹ United Nations, *World Population Prospects: The 2012 Revision*, Retrieved, http://esa.un.org/unpd/wpp/unpp/panel_indicators.htm

Table 13: UAE Population Spread by Age from 1980 – 2050

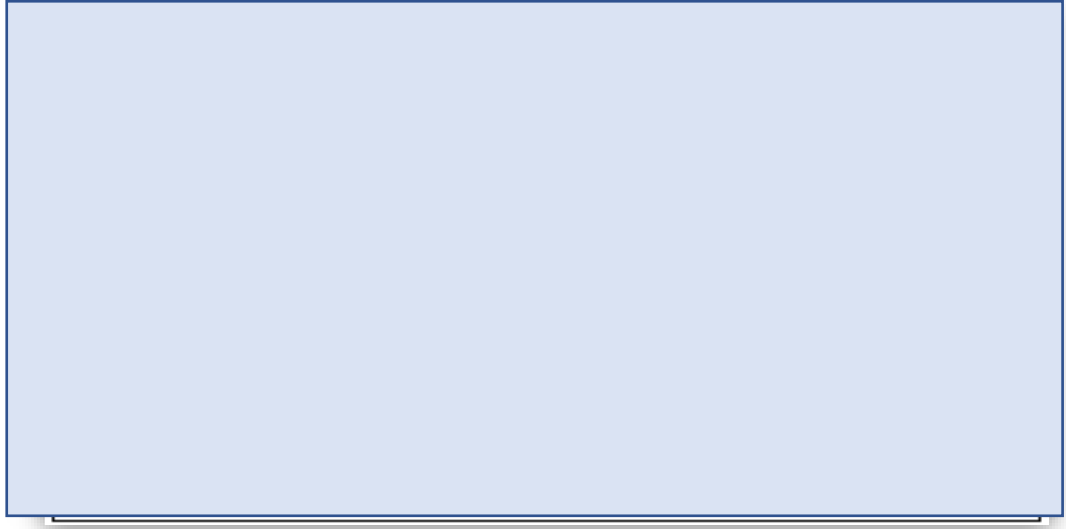
Year	Population by Age Group (%)			
	0-4	5-14	15-64	65+
1980	12.9	15.1	70.6	1.3
1985	13.8	18.0	66.8	1.3
1990	12.5	18.5	68.0	1.1
1995	9.3	17.5	72.2	1.0
2000	8.6	16.8	73.6	1.0
2005	7.0	13.1	79.1	0.8
2010	6.4	7.50	85.8	0.3
2015*	7.0	9.10	83.4	0.5
2020*	5.3	11.5	82.4	0.9
2025*	4.0	10.7	84.0	1.3
2030*	3.8	8.30	86.2	1.8
2035*	4.0	7.00	86.1	3.0
2040*	4.2	7.00	81.3	7.5
2045*	4.0	7.50	72.6	15.9
2050*	3.6	7.60	64.2	24.6

Source: United Nations, World Population Prospects: The 2012 Revision.

The UAE population structure has changed significantly in the last century. In 1950, the population structure across the genders assumed a bell structure with more people at the lower ages and fewer from 45 – 49 years and above¹⁹⁰. The figure below illustrates the population structure back then in 1950.

¹⁹⁰ United Nations, *World Population Prospects: The 2012 Revision; Projections* (medium variant). Retrieved, <http://www.un.org/esa/population/publications/wcu2010/Main.html>

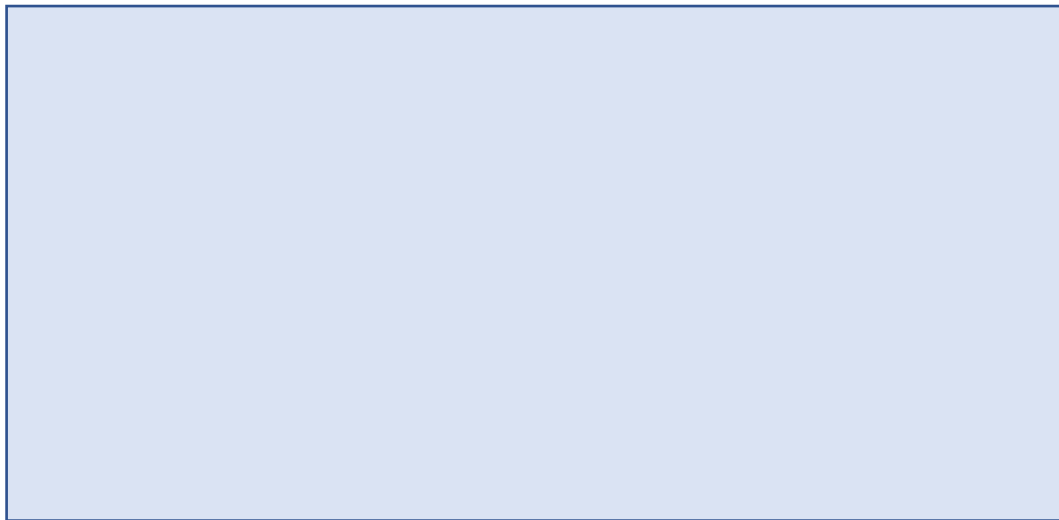
Figure 22 (B): UAE Population Pyramid in 1950



Source: United Nations, *World Population Prospects: The 2012 Revision*

By 2010, the UAE population pyramid assumed a sledgehammer structure with more males than females from the 20-44 year age groups as shown in the figure below. This change was attributed to the increase in male migrants from the rest of the world to the UAE to cover the labor demand¹⁹¹.

Figure 22 (c): UAE Population Structure by 2010



Source: United Nations, *World Population Prospects: The 2012 Revision*

¹⁹¹ United Nations, *World Population Prospects: The 2012 Revision*, Ibid.

Moving towards the year 2050, the UAE population is expected to adopt a more inverted pyramid shape with the males being more than females going by the cultural trends of assigning jobs and tasks along gender lines¹⁹². The following figure illustrates this population projection.

Figure 22 (D): UAE Population Structural Projection by 2050



Source: United Nations, *World Population Prospects: The 2012 Revision; Projections*.

Whereas the UAE people aged 15-24 year age group composed just 14.3% of the entire population, only 21.3% attained the employable age by 1985. By 2010, the 15-24 year population age group rose to 23%, whereby 26.8% attained employable age. However, the 15-24 year population age group is projected to decline to 9.3% by 2025 of which only 11.1% will have attained employable age, then slump further to 11.2 % by 2030 and 7.30% by 2045. The 15 – 24 year population age group could increase to 7.5% by year 2050¹⁹³, as shown in the table below:

¹⁹² United Nations, *World Population Prospects: The 2012 Revision*, Ibid.

¹⁹³ United Nations, *World Population Prospects: The 2012 Revision*, Ibid.

Table 14: UAE Demographic Structural Trends

Year	Youth (thousands)	Youth (% of total population)	Working-Age population (thousands)	Youth (% of working-age group)**
2000	483	16.0	2,228	21.7
2005	721	17.4	3,283	22.0
2010	1,938	23.0	7,243	26.8
2015*	1,162	12.1	7,983	14.6
2020*	912	8.6	8,733	10.4
2025*	1,069	9.3	9,640	11.1
2030*	1,384	11.2	10,623	13.0
2035*	1,394	10.6	11,359	12.3
2040*	1,184	8.4	11,435	10.4
2045*	1,090	7.3	10,774	10.1
2050*	1,156	7.5	9,933	11.6

Source: United Nations, World Population Prospects: The 2012 Revision.

5.4 Environmental Vulnerability to Disaster

The United Arab Emirates (UAE) sits on a portion of Arabian Platform, a spread of continental rock that encompasses both present-day Arabia and shallow Arabian Gulf, in addition to rocks of Iran's Zagros Mountains. It is believed that Arabian Platform remained stable since Cambrian Period over 500 million years ago. Also, Arabian Platform has been part of Afro-Arabian Continent for most of its history. They were united in response to movements of tectonic plate. Some 25 million years ago, Arabia began separating from the African plate with Red Sea's initial opening.

In the UAE, Pre-Cambrian rocks neither outcrop nor its existence known from any drilling information sources. However, Pre-Cambrian sedimentary rocks exist in neighboring countries of Saudi Arabia and Oman, which is an indication of the emirate region's participation in the late Pre-Cambrian glaciations whose geologic evidence is available in many parts of the globe.

The area, which is now known as the UAE, has been in proximity to the Afro-Arabian continent from the time back to middle Cambrian Period. In general, it was covered by a shallow sea.

From the visible Cambrian sediments on two sides of Arabian Gulf, it was inferred that the UAE region may have been the place of early-stage rifting of a bigger continent to form a new ocean basin. This inference, if taken into consideration, becomes detrimental in the UAE's later position at the continental margin, the map below shows the Gulf cooperation countries GCC environmental and geographical features.

Figure 23 Middle East and GCC Geographical environment



Ahmed AL Marzooqi 2017

The UAE possibly glaciated together with most of North Africa as a result of movements of the Afro-Arabian plate at the time of Palaeozoic that also made Arabia to pass near the South Pole maybe in the Ordovician period. It is also believed that the Afro-Arabian continent was part of southern supercontinent Gondwana in the mid-Palaeozoic period. The supercontinent later broke up in the Permian and Triassic. Despite many

movements, the UAE continued to remain in subtropical or tropical latitudes, and tectonically stable. It led to formation of Hajar Mountains along its eastern margin, which is discussed below separately. In a nutshell, the UAE's geological history has primarily been about the advance and recede of the sea due to global climatic and tectonic fluctuations.

Arabian Platform

The Arabian Platform is structurally a lowest unit observed. In the UAE, it is represented by a thick shallow-water carbonates that belong to late Permian to mid-Cretaceous, exposed in the mountain of Ru'us al-Jibal, located in Oman.

Geologists refer these structures of limes collectively as Hajar Supergroup. The carbonates could be correlated with oil-bearing strata that lie deeply buried to the west.

Within Hajar Supergroup are various horizons that contain shallow-water marine fossils, including pipe corals, trace fossils, bivalves, gastropods, brachiopods, crinoids, and cephalopods.

In the UAE, Arabian Platform's pre-Permian basement is known from fragmentary and localized outcrops of Paleozoic shallow-water clastics close to Jebel Qamar South and Al-Ghail Village. These outcrops are collectively called Rann Formation. The estimated age of it ranges from Ordovician to Devonian, as indicated by the scarce fossils. Also, the carbonates of Ru'us al-Jibal have most likely deposited inconsistently above the pre-Permian basement.

Hajar Mountains

Hajar Mountains are known for being the highest mountain range in the eastern Arabian Peninsula and runs parallel to east coast of the UAE heading towards south-east side into Oman. In this area, these mountains are geologically divided into two main ranges. These mountains start in the north forming Musandam Peninsula which lies within the Musandam province of Oman.

The mountains in the region are locally known as Ru'us al-Jibal for having high peaks that go as high as 2,000 meters. It exposes a heavyset sequence of Mesozoic sediments of carbonate, deep beneath it runs principal oil-bearing strata to the south-west.

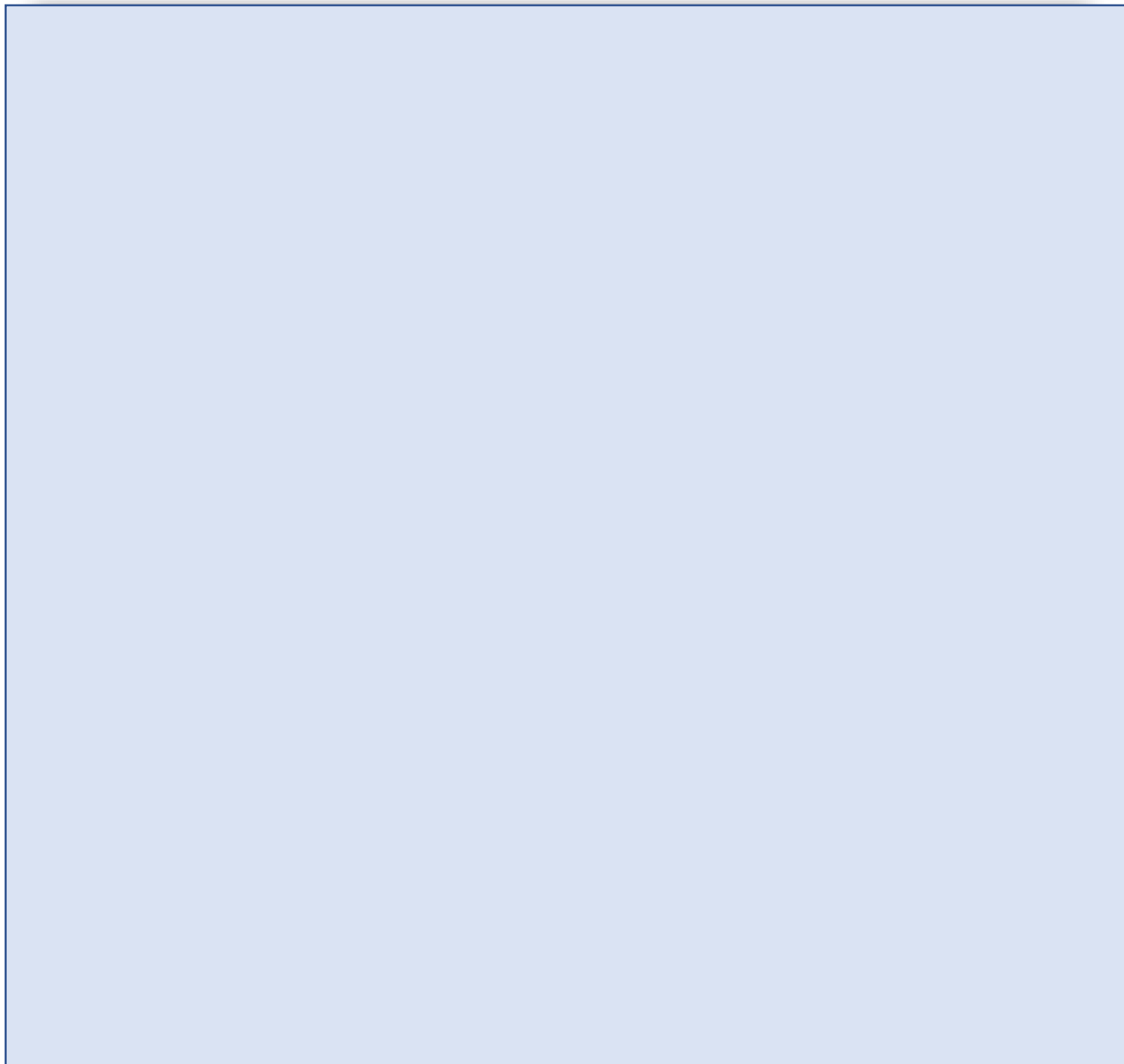
The Hajar Mountains are relatively lower to the south side of Ru'us al-Jibal, where peaks reach about 800 to 1,600 meters. Interestingly, the mountain in this region comprised of unique complex of igneous rocks reminiscent of an ocean's crust and upper mantle perhaps once laid to the north-east.

The rocks, which originally might have formed underneath a zone of sea-floor spreading deep in the earth, now lie on top of Arabian Platform's present-day shallow water sedimentary rocks. In addition, these rocks are associated with deformed sediments that were deposited on the floor of erstwhile Deep Ocean.

Formed due to the mantle and oceanic crust and exposed together on the surface, these rocks are collectively known as ophiolite. In Hajar Mountains, the ophiolite exposure runs up to 500 kilometers stretching from the UAE's Dibba to Oman's Muscat. The ophiolite of Hajar Mountains is known for best preserved in the world.

However, in order to understand the unique geology of the Hajar Mountains it recommended to go through the area's history of tectonic plate, following figure 24(B) illustrate the UAE Mountains and highlands.

Figure 24 the UAE map of Mountains and Highlands.



Source: UAE Interact, 2002, p. 52

Sand Desert

The UAE is primarily covered by sand desert as a land surface. The desert stretches from the Arabian Gulf coast in North to uninhabited sands of Rub' al-Khali (Empty Quarter) in South and gravel outwash plains in East bordering Hajar Mountains. Geologically, the desert is considered a recent feature that resulted from prolonged subaerial erosion in the region and re-deposition in an arid environment.

The sands lie upon Arabian Platform's oil-rich sedimentary strata, which act as foundation bedrock for the UAE. However, most of the oil- and gas-producing rocks have no surface exposure hence drilling is required to determine its presence. Sands in the desert region vary in composition and form: sand in areas near the coast is stabilized by vegetation while in inland sand is quite barren as there's less scope for vegetation to survive.

Sand Dune Patterns

Formation of dune patterns is a poorly understood phenomenon. In general, the formation of sand dune is controlled by variety of factors including wind strength, its direction, and sediment supply. The dune pattern may change from place to place; at a given area it may be quite regular but intricate.

Sand dunes have typical physical features that are measured on different scales. In general, giant sand ridges could be hundreds of meters to some kilometers, sand dunes could be some meters to tens of meters, and ripples could be some centimeters to a meter or more. In the UAE deserts, this hierarchy could easily be observed.

Sand dune patterns are not static always; they may change with wind direction. It is worth noting that occasional or seasonal variations in wind direction may introduce altogether new elements into the sand dune pattern. These new elements are likely to either reinforce or nullify each other, in a similar way as ocean waves do.

Among sand dunes, Barchan are simplest ones. Barchan dunes have unique crescent shapes. They have outward curve in the upwind direction, a soft upwind slope, and a steep slip face downwind. These sand dunes generally form in areas with limited sediment supply. They are most often spotted atop salt flats or gravel plains. Barchan dunes may form several dozen fields that advance across flats.

Transverse dunes, which are asymmetrical, elongated sand ridges with a sloping windward side and steeply sloping leeward side, form vertical to the prevailing wind direction. In the UAE, most of the dunes are of this type.

Sabkha Environment

Sabkha is an Arabic term commonly used by geologists to mean low-lying salt flats subject to their periodic inundation. In general, there are three types of Sabkha based on their formation environment. Interestingly, all types are available in the UAE. Those three types are: Coastal sabkha, Fluvio-lacustrine sabkha, and Inland or interdunal sabkha.

The first type sabkha, as its name imply, forms close to at marine shoreline. The second type sabkha forms in arid areas in association with lake drainage systems or river. The third type of sabkha is found in within sand desert in low-lying basins.

Sabkha displays various surface phenomena. On a dry sabkha, puffy and irregular crust of freely cemented salts and fine sediment are seen. Salt crystallization leads to expansion which may create raised polygonal patterns. On the other hand, desiccation leads to shrinkage resulting in creation of polygonal ‘mud cracks’. On coastal sabkha, dark mats of blue-green algae (a.k.a cyanobacteria) develop resulting in a distinctive wrinkled surface. In each case, atop or among these surface irregularities, subsequent salt deposition or wind-blown sediment is observed.

A flat sabkha surface possesses resistance to erosion by wind because of its dampness and surface grains cementation by precipitated salts. A dry sabkha is suitable for vehicle transportation for being firm, but it becomes treacherous after rains. Though a sabkha is not quicksand, the subsurface crust supports weight of animals, human beings and ordinary vehicles.

Coastal Sabkha

Coastal sabkha in the UAE is world famous. It prevails through the coastline from Abu Dhabi Island westwards, extending over 15 kilometers inland. The flat coastal sabkha has its surface above the level of normal high tides. It means coastal sabkha is flooded only when there are heavy rains or a storm surge with spring tides.

A characteristic sequence is visible from cross-sections through the sabkha. From top, it starts with halite and then goes downward to anhydrite, gypsum, calcareous mud, and ends with bacterial layers at the bottom. All these are above dune sands (Evans et al. 1969; Kirkham 1997).

In a nutshell, this sequence shows the development of the coastal sabkha. For the development of gelatinous mats of cyanobacteria, high intertidal zone plays prominent role of traps calcareous sediment fetched by tides. It must be noted that the very sediment is an outcome of precipitation of calcium carbonate.

Sabkha Matti

A large and ill-famed sabkha, known as Sabkha Matti, is situated in the west of the UAE. This Sabkha extends over 100 kilometers inland. Till recent years, the Sabkha was no less than a bane for overland travelers. In the country, it has been classified as a fluvio-lacustrine sabkha. This Sabkha has been regarded as estuary and confluence of many rivers that drained desert region Empty Quarter at some point of time in the past. (Goodall 1994; Whybrow et al)

The contemporary sabkhas' location and extent may be known with the help groundwater permeating in buried watersheds. It is believed that Sabkha Matti was wrapped up by sand dunes during the latest glaciations. However, contemporary winds flowing from North to South might have removed sand dunes from the sabkha.

Interdunal Sabkha

The Liwa area is a good example of interdunal sabkha in the UAE. It is a place where numerous sabkha flats are enfolded by a major sinuous dune ridges. Unlike other sabkha flats in the UAE, this region's sabkha flats are drier but get flooded for weeks whenever there are heavy rains. The very existence of such sabkhas is a clear testimony to historical proximity of groundwater.

Locals have preserved traditional wells within the Liwa area, while new troughs are being razed. In such wells, water level remains within two meters below the surface. But water table reportedly dropped to ten meters in the Liwa oasis, due to rising agricultural demand.

Within the UAE, the Liwa area is famous for its sand roses as there are many beautiful natural formations that resemble stone flowers. These sand roses borne out of gypsum-cemented sand's flat discs interlocking. These discs are formed usually by subsurface precipitation at water table. Nowadays, these sabkhas in Liwa are filled with sweet sand to make it useful for agricultural use.

Tectonic Plate/Metamorphic Contact

Metamorphic Sole

Contact metamorphism of rocks at their bases locally led to emplacement of ophiolite nappe at various places. It involved both ophiolite and underlying sediments. In some cases, the metamorphism is good enough to produce amphibolites or garnet schists. The metamorphic sole, along the Masafi town's road on north-side, is visible as silver-white rocks. These rocks are primarily schists and marbles.

Hawasina Nappes

Hawasina Nappes comprised of deep ocean sediments deposited in Tethys Ocean. These units were stacked at subduction zone and then pushed ahead of the advancing ophiolite. Their age could be somewhere between late Permian to mid-Cretaceous.

They are therefore contemporary with Arabian Platform's shallow-water carbonates, and now overlie it. Though a good number of subunits were identified and mapped, the internal structure of Hawasina Nappes is complex due to its periodic movement and undergone deformation of these rocks.

The sediments of Hawasina comprise thin-bedded carbonates and mudstones, cherts in red and green colors, turbidites, fissile shales, some volcanic rocks, and continental slope and rise clastics which include piled up shelf limestones. These colorful sediments could be seen easily in the Dibba zone within the UAE along southern border of the mountain Ru'us al-Jibal.

In addition, these Hawasina sediments can also be seen in the Wadi Sumayni area over the Oman border. Some large blocks of white reef limestone are also seen atop of the Hawasina sediments. This limestone turned to marble known as exotics, and potentially forms clusters of small or large peaks. Usually, the exotics are usually associated with

volcanic rocks. They are believed to represent coral atolls or banks of limestone that formed over the top of submarine ridges or seamounts.

In the UAE, there's no existence of major exotics. However, some exotics are noticeable at Jebel Ghaweel over the Oman border, and near Shuwayhah and Shiyah villages – all off the road from Jebel Rawdhah to Oman's Mahdhah territory which borders the UAE.

In Hawasina Nappe, exotics and their associated volcanic rocks as called Umar Group or Haybi. On the other hand, sediments that represent continental slope and rise are termed as Sumayni Group.

Climate

The UAE primarily has an arid climate with considerable oceanic effects because of Arabian Gulf and the Gulf of Oman in its proximity. Typically, the winter remains warm and dry in the region while the summer brings high temperature augmented by humidity due to coastal effects. However, high altitude mountains of Al Hajar al Gharbi in the UAE make weather conditions cool. These factors largely determine climatic conditions in the UAE and characterize two main seasons. In general, winter starts in November and lasts until March with a temperature that goes as low as 6 degree Celsius but not lower than that.

In the country, summer is usually dry and begins in April and lasts till September with temperatures going as high as 48 degrees Celsius in coastal cities where humidity levels also rise to a staggering 90% at times. Southern desert regions see high temperature which goes up to touch 50 degree Celsius. In summer, a common phenomenon is violent dust storms and irregular rainfall. In coastal areas, average humidity level is 50% to 60% but it declines inland where average is 45%. Month-wise, the humidity is high during winter months and low especially in May.

Another important climatic factor is evaporation, whose rates are usually very high reach nearly 8 mm per day on an average. Temperature fluctuation is observed during winter months in desert areas where it can also dip to zero while day remaining warm.

Rainfalls are rare in the region. During the winter, rainfalls occur as a result of a mix of atmospheric depressions and Mediterranean winds from northwesterly direction. Typically, February and March are recorded as the wettest months. In coastal areas, the

rainfall levels in summer are very low but good in mountainous and southeastern regions – where average rainfall remains in the range of 140 mm to 200mm. During 1970-2001, recorded annual rainfall averaged nearly 120 mm. In the same period, driest years saw rainfall levels going almost 20 times lower than the levels in the wettest years (Figure 1-2). A wide fluctuation level is apparent in average monthly rainfall. The country receives most of its rainfall between January and April. These are the months with lowest temperature. During the summer, the rainfall levels are uniformly low throughout the region especially between July and October.

Temperature also fluctuates in the UAE in terms of area and time. During 1970-2001, the average temperature was nearly 27 degree Celsius. The data of average monthly temperature shows trends.

Climate Change - Effects

In the UAE, its largest dune features including ridges of Manadir, Liwa, and of Northern Emirates and central Abu Dhabi are believed to have formed during latest glacial period that attained its climax nearly eighteen thousand years ago.

Glaciation in northern latitudes has played its role in sand dune development in the country in two ways. On one hand it compressed width of climatic zones between ice front and the equator, resulting in stronger global winds. On the other hand it led to global sea level shrinkage, resulting in emptied Arabian Gulf that exposed a huge volume of loose sediment which acted as source material for sand dunes (Glennie 1991; 1996; 1997).

The connection of glacial period origin and major dune features in the UAE is corroborated with the fact that the dunes are not aligned with contemporary winds. The latest wind regime apparently transports material from the coast inland and reworks the surface of the major earlier structures without even disturbing their orientation.

For example, one can see large tongues of pale sand amid the Liwa oasis and Abu Dhabi that resemble a rough sea of transverse dunes which are aligned NE to SW and filling in broad troughs amid higher, flatter red sand ridges that are aligned WNW to ESE. The latter are understood as the scoured cores of major linear dunes.

Images from satellite indicate development of minor linear alignments with orientation from NNW to SSE on many ridges in the area north of Liwa. As of now, further inland

major dune ridges of Manadir and Liwa are apparently neither in motion nor deflated, despite the fact that dune ridges of Manadir possess multiple characteristics of transverse dunes. It is observed that the sharp crests of active dunes may become rounded or flattened after rains. The contemporary wind direction in the country is from NW, so the most active dune crests are aligned NE to SW with their steep faces to SE. However, a major subsidiary wind direction is from SE. In addition, powerful SE winds occurring occasionally could create temporary 'reverse' crests at the tops of dunes which are otherwise oriented to NW winds.

This unusual phenomenon makes it difficult for drivers to drive in the dunes. Apart from wind regime changes, the deserts of the UAE also experienced changes in annual rainfall in the recent past.

Demography

Population in the UAE is an ever increasing phenomenon, largely due to influx of expatriates. During 1994 to 2004, the population growth rate stood at 6.8% per year which is quite high. When natural population growth is taken as an indicator, it reveals a decrease in growth from nearly 2.2% per year to 1.3% per year over the same decade.

The total population in the country in 2004 was close to 4.32 million, an increase of 6.9% from 2003 and more than 15 times the population recorded in 1971. There's gradual decrease in infant mortality rate in the country, along with improving life expectancy and inflow of expatriates. These factors have paved the way for the UAE to become second most population nation within six GCC states.

The population within the emirates is unevenly distributed. Close to 85% of the total population of the UAE is concentrated in the emirates of Dubai, Abu Dhabi and Sharjah, while remaining 15% live in emirates of Ajman, Fujairah, Ras al Khaimah, and Umm Al Quwain. An interesting fact is that a majority of the UAE population have dwell in urban areas in coastal zones.

In 2004, the country's largest city and federal capital Abu Dhabi had population of nearly 1.67 million. In the same year, commercial hub and port city Dubai had population of about 1.30 million. On the other hand, Al Ain had largest inland population concentrated in and around the city covering Oman border.

Population trends of the emirates population (see Figure 1-3) could be summarized for several years from 1975 till 2004. In the UAE, young age groups showed high rate of population growth. People in those groups were younger than five and between 20-44 years old. The latter age group had more expatriate workers. During the period, people older than 65 were mostly citizens of the UAE.

In the UAE, there were about 2.93 million males and nearly 1.39 million females in 2004. The ratio of 2:1 is perhaps due to more number of male expatriates.

Within the emirates, women traditionally played a significant part in the society. They enjoyed many rights as their male counterparts – education access, legal status, liberty to choose profession, claim to titles – all these are enjoined in the Constitution of the UAE.

When it comes to literacy of women, it rose to a whopping 84% in 1995 from 31% in 1975. This translated into participation of women in the workforce. In 1995, an impressive 44% of total federal employees in the UAE were women, with almost 65% teachers being women.

The country has invested considerably in public education in the past three decades. It guarantees free access to education to all citizens, starting from primary through secondary. In the UAE, primary education remains compulsory. As result of various measures in education to improve school system, increase school enrolment and open adult education centers, literacy rate rocketed. In 1970, the literacy rate for men was 24%. It is 79% for men and 84% for women now.

Water Supply

Water supply assumes high importance for the UAE, which has dry region, ever-growing population, fast economic development and an Emirati policy for agricultural self-sufficiency. Like any other country, the UAE's Ministry of Agriculture and Fisheries through its various departments oversees management of dams, irrigation water and meteorological data.

Though there's less than required annual rainfall and no perennial streams in the UAE, the country stands at third position worldwide in terms of per capita water consumption. In 2005, the UAE's water consumption was nearly 4,180 Mm³. Agriculture sector consumed a whopping 60% of total water. The domestic consumption was about 25%, industrial activities consumed 9% and landscaping consumed 6%. Water supply needs are

fulfilled in three ways in the country: ground water, desalinated water, and treated waste water.

In fact, desalinated water and treated wastewater have become a necessity in addressing an ever growing water supply demand when natural water is inadequate in the UAE. The country uses groundwater to meet domestic water demand in rural parts of the emirates. It is also used in cultivation of high value crops.

As per the data (see Figure 1-10), groundwater is situated in four main aquifers which are recharged every year by nearly 120 million m³. This recharge is even below 5% of annual water consumption of Abu Dhabi.

Quaternary is the primary aquifer system in the UAE, and it comprises sand and alluvial gravels on two sides of northern Oman Mountains. It houses the UAE's largest fresh groundwater reservoir having yearly extraction equal to nearly 2,650 Mm³.

Over the last two decades, water table has gone down by over one meter and saltwater intruded into coastal area soils primarily due to persistent overuse of groundwater resources. Other traditional water resources such as falajes (water channels) and small dams are also used extensively. The UAE's water ministry built up 113 recharges and minor dams to tap rainwater and use an approximately 150 million m³ water a year from 15 catchment areas.

The country is well prepared to collect 47 Mm³ water from flood per year in its nine large recharge dams, in addition to collecting nearly 60 Mm³ of flood water a year in its other 104 minor dams. Traditionally, falaj system is used to capture rainwater and use it in the desert. Typically, the man-made water channel or tunnel is constructed such that it not only intercepts groundwater table through one or more wells at high mountains' foot slopes but also push water to the surface. There are as many as 40 such operational water channels in the UAE, mostly in eastern region. Average discharge of falajes per year is nearly 31 Mm³, as per the data from Abu Dhabi's Environment Agency.

The UAE has a sound process for water desalinization, besides electricity production and excess heat produced reuse. As many as 22 desalination plants/stations in the country produce desalinated water at their combined installed capacity of about 1,504 Mm³ per year, according to a 2004 data from the Energy-Electricity ministry.

Even though there's no national strategy available for water resource management, a number of water conservation measures have been implemented across the UAE, particularly in agricultural sector where a slew of techniques are being promoted to for water conservation.

The local Emirati governments are undertaking public awareness campaigns to educate general masses about water conservation and its need. As of 2008, a long-term plan for water conservation and water resources development in a sustainable manner was about to completed.

Transportation

Along with economic development of the UAE, transport too saw considerable growth despite the fact that the region is a desert with plenty of sand dunes. Now the country has advance transport infrastructure in the form sophisticated roads, ports and airports.

As per a 2003 estimate, the UAE had more than 4,000 km of paved highway with its main road connecting key coastal cities and neighboring Arab countries including Qatar and Saudi Arabia.

In the same year, car ownership was close to 200 vehicles for every 1,000 people. The car ownership rate grew by about 2% annually in recent years. The UAE implemented measures to develop sustainable transportation policies. A good example of such policies reflects in Dubai metro project.

Maritime trade has always been important for the UAE economy. Being in proximity to the Arabian Gulf, the country has considerable say on an important trade route between South East Asia and Europe. Besides fifteen commercial ports, the UAE has umpteen number of fishing harbors along its coastline. These ports serve as a platform to import and export raw materials, oil and finished goods for many local consumers and industries. The UAE stands out among other countries to remain as world's one of the top five locations for bunkering and ship supplies.

The country's aviation industry too grew steadily in last two decades, resulting in better business and tourism. As of now, the Emirati nation has six international airports. Between 2002 to 2003, these airports recorded an increase of 5% in aircraft movement and passenger throughput growth of 11.2%. Besides facilitating boon in the air transport, the UAE's General Civil Aviation Authority (GCAA) had a strategic plan for 2004 to

2013. This plan called for economic diversification, aircraft fleet expansion, and capital expenditure growth by the GCAA.

CHAPTER 6: DETAILED ACCOUNT OF NATURAL DISASTERS AT GCC AND UAE

6.1 Natural Disasters in GCC and UAE

The UAE is an Islamic nation in the Middle East, GCC and Greater Asia. The country's geographical location around the Arabian Plate between the Iranian plateau and the Zagros Fault exposes to various natural disasters. This region has a history of seismic movements as evident from the documentation. Additionally, the population of the UAE has been growing rapidly, and the pressure for settlement areas is leading people to migrate to places deemed prone to natural disasters. Therefore, the UAE has increasingly become exposed to the same hazards¹⁹⁴. This chapter covers specific natural disasters that have occurred in the UAE. Each disaster is covered in details including the year, location and impact to human beings and property.

6.1.1 Al Qurayah Floods Disaster of 1995

Al Qurayah town lies in the Indian Ocean Coast (25° 14' 22N - 56°2138E), north of Fujairah City. The town is close to Hajar Mountains just before the Safad valley. By 2010, the town had about 5,000 people. The Al Qurayah floods occurred on Friday December 11, 1995 after torrents of rain for three consecutive days. Due to huge volumes of water runoff, the Al Qurayah floods of 1995 caused the breakdown of the local dam. Water moving at terrific speeds overran the dam's banks and considering that vast lands of the UAE are dry most of the year, it was difficult to manage the sudden discharge at impulse. The hard crust on the soils means that water was not able to percolate and drain down as fast as expected. For that matter, this flood was very different from the others caused by heavy rains even though they also occur abruptly¹⁹⁵.

Every year, heavy rains in the UAE cause immense overflow to the surfaces and occasionally some flooding is experienced. This was typical of the Al Qurayah floods in December 1995. However, what caught many people by surprise was the three days of continuous torrents of rain pounding the area, leading to overcapacity of the local dam

¹⁹⁴ Dhanhani, Duncan & Chester, p. 65.

¹⁹⁵ Dhanhani, p. 181

and massive overflows. Eventually, the dam's banks burst from the pressure of the water volumes. More than 90% of the Al Qurayah land mass was covered by the floods. Among the damages were farms, highways, houses, offices and other fixed and movable assets belonging to the residents in that area¹⁹⁶.

As the dam broke off on the slopes of the mountain, the water gaining gravity carried houses along as well as any other loose properties afloat. By the second day, the town's food and drinking water supply was interrupted and the process of migration out of the town kicked off in earnest. Most internally displaced people went to look for safer grounds¹⁹⁷. The water coming down the slopes swept a lot of debris to the roads and residential places. Over 90% of housing structures in Al Qurayah were brought down or weakened by the floods. As the water levels rose up, thousands of livestock were swept along dead or injured.

Even housing structures along the beaches were damaged as the floods velocity was at peak. In normal circumstances, the Al Qurayah dam tributaries were from Safad valley and the main valley in Fujairah emirate. By the time of the flooding, the Al Qurayah dam was at over half a century old, but it appears the local authorities were not servicing it adequately. Hence, when the heavy rains and storms hit, there was massive breakdown and unprecedented flooding. The floods also cut off the town's power lines since the electric posts were uprooted¹⁹⁸. In 1995, UAE did not have a national disaster management body to coordinate rescue efforts of such magnitude.

The motivation of the Dubai Police was to minimize loss of human lives, property erosion and generally assure the public that all was in control. Yet, the entire process kick started without a formal disaster plan. Within hours, the Dubai Police were overwhelmed and had to be assisted by the Fujairah Civil Defence (FCD). By the third day, there were no human lives lost but over 90% of the housing structures were damaged. Additionally, the rescue teams succeeded in evacuating the stranded population by the third day¹⁹⁹.

Reports indicate that the Dubai Police rescue team was mobilized within 12-15 hours from the time the dam burst its banks. However, since there was no prior disaster

¹⁹⁶ Dhanhani, p. 181.

¹⁹⁷ Dhanhanim p. 182

¹⁹⁸ Dhanhani, p. 182.

¹⁹⁹ Dhanhani, p. 183.

management plan in place, the earlier phase was delayed by the lack of proper communication. There were complaints that some senior uniformed officers in the military were issuing conflicting instructions yet they had no training in such scenarios. In some cases, there were multiple instructions issued for the same task while other tasks had duplicate personnel assignments. Generally, the entire coordination of Al Qurayah rescue efforts was conflicting in very many cases²⁰⁰.

The fact that there was no clear disaster rescue plan or policy also implies that the roles were conflicting. This was evident in the roles of the Dubai Police and the Fujairah Civil Defence. If the roles were clear, some of the infrastructure losses such as power blackouts were avoidable. However, since power was switched off past midnight on the first day, there was poor visibility, which prevented people from viewing the rising sea levels and waves. The entire Al Qurayah disaster rescue challenges exposed the nation's ill preparedness, inadequate equipment, shortage of devices and untrained logistical human resources²⁰¹.

The Red Crescent was involved in the Al Qurayah rescue efforts for a limited role of offering the affected people temporary shelters, safe water and minimizing incidences of disease outbreaks. The Red Crescent was tasked with aiding the most vulnerable families. Nevertheless, Red Crescent was not very successful according to complaints of some vulnerable families that the supplies were late in some cases or unfairly distributed²⁰².

It was critical that FCD were inept while responding to the Al Qurayah disaster, could have achieved better results if they had more coordination, communication and equipment within the team such as boats, and jackets²⁰³. Typical of other global disaster rescue efforts, the system coordination is always the cause of challenges. Therefore, most international and regional disaster rescue organizations have laid down procedures for any events, defined roles and logistical structures²⁰⁴. Furthermore, disaster rescue efforts under inter-agency coordination are more effective because they complement each other's weaknesses.

²⁰⁰ Dhanhani, p. 183.

²⁰¹ Dhanhani, p. 184.

²⁰² Dhanhani, p. 184.

²⁰³ Dhanhani, p. 184.

²⁰⁴ Litman, T. *Lessons From Katrina and Rita* Victoria Transport Policy Institute 1250 Rudlin Street Victoria, 2006.

In response to the damages caused by the Al Qurayah 1995 floods, the government offered US\$ 4 million for the reconstruction of the water dam and additional three flood breaks were set up at Safad and Thayb on grounds higher than Qurayah town. The government contracted some firms specialized in dam management. The objective of the water breaks was to harvest the extra rainwater and channel the same to the country's vast farmlands, which are in dire need for the irrigation water most times of the year²⁰⁵. The rest of the water goes to underground storage systems, and later pumped to the surface according to the needs. Therefore, many farmers around Al Qurayah have sufficient water for their farming needs especially during the summer. Another role for the breakwaters is to ensure the residential buildings are safe from future floods.

Later the UAE government helped in reconstructing houses for the affected Al Qurayah populations. These house reconstruction works were accompanied by distribution of cash for some whose farmlands were destroyed²⁰⁶. In terms of the success of the Al Qurayah disaster management, various lessons were learnt. The fact that the geographical location is at the slopes of mountain, near the sea and between valleys should have informed the respective disaster rescue agencies and the government to prepare appropriately²⁰⁷.

The lack of proper dam management and maintenance schedules should have informed authorities that any slightest flooding would cause a disaster. Lack of systems to contain floods also contributed to the disaster as simple consideration for breakwaters would have made a remarkable difference since the authorities have prior knowledge about the weather patterns²⁰⁸.

Even though the Al Qurayah floods were a natural disaster, it is evident that presence of warning systems would have enabled the residents to be more precautionous. It is clear that the rising number of similar disasters is due to lack of planning and management protocol and responsibilities. Moreover, lack of government regulations on how residential areas are to be constructed is another major cause of vulnerability to such disasters. Establishing proper disaster mitigation procedures with coordinated logistical

²⁰⁵ Dhanhani, p. 185

²⁰⁶ Dhanhani, p. 185.

²⁰⁷ Dhanhani, p. 186

²⁰⁸ Dhanhani, p. 186.

plan is a good way of approaching similar floods if they were to recur at Al Qurayah town. Regular training and disaster drills by the civil Defense together with availing equipment are sure ways of tackling similar disasters in future. Such teams must be able to access the scenes using rapid means like helicopters as the entire roads were destroyed in the case of Al Qurayah floods. Frequent flooding hazard analysis would have enabled the residents and authorities at Al Qurayah to take the necessary steps and minimize damages²⁰⁹.

6.1.2 Masafi Earthquake Disaster of 2002

Masafi is a small residential area near the Hajar Mountains of the UAE and established on the road from Fujairah to Sharjah and lies between two major emirates, Ras Al Khaimah and Fujairah. It is probably the highest altitude in the entire UAE and the location is known for fruit cultivation. Masafi is 25° 18 48 N, 56° 9 46 E and by the time of the earthquake, had 4,000 residents. Masafi residents are largely peasant farmers and very passionate of sheep rearing and sales²¹⁰.

The Masafi earthquake of 2002 occurred at a time when majority of the population were aware of the causes²¹¹. The earthquake measured slightly above 5.1 on the Richter scale and occurred around the Dibba fault²¹². The depth of the earthquake was 10 km while the epicenter was 20 km North West of Fujairah along the Dibba fault²¹³. The earthquake is also near the Oman Mountains, which has a history of active fault movements. The location is dominated with metamorphic and Semail ophiolite rocks, which also covers majority of the UAE²¹⁴. The earthquake occurred on March 11, 2002 at

²⁰⁹ Dhanhani, p. 186-187.

²¹⁰ Fujairah Municipality Personal interview 2009

²¹¹ Al Homoud, A. 'The Fujairah, United Arab Emirates UAE ML = 5.1 earthquake of March 11 2002 a reminder of the immediate need to develop a national hazard mitigation Strategy,' *EGS - AGU - EUG Joint Assembly, the meeting held in Nice, France* 6 - 11 April 2003. 2003.

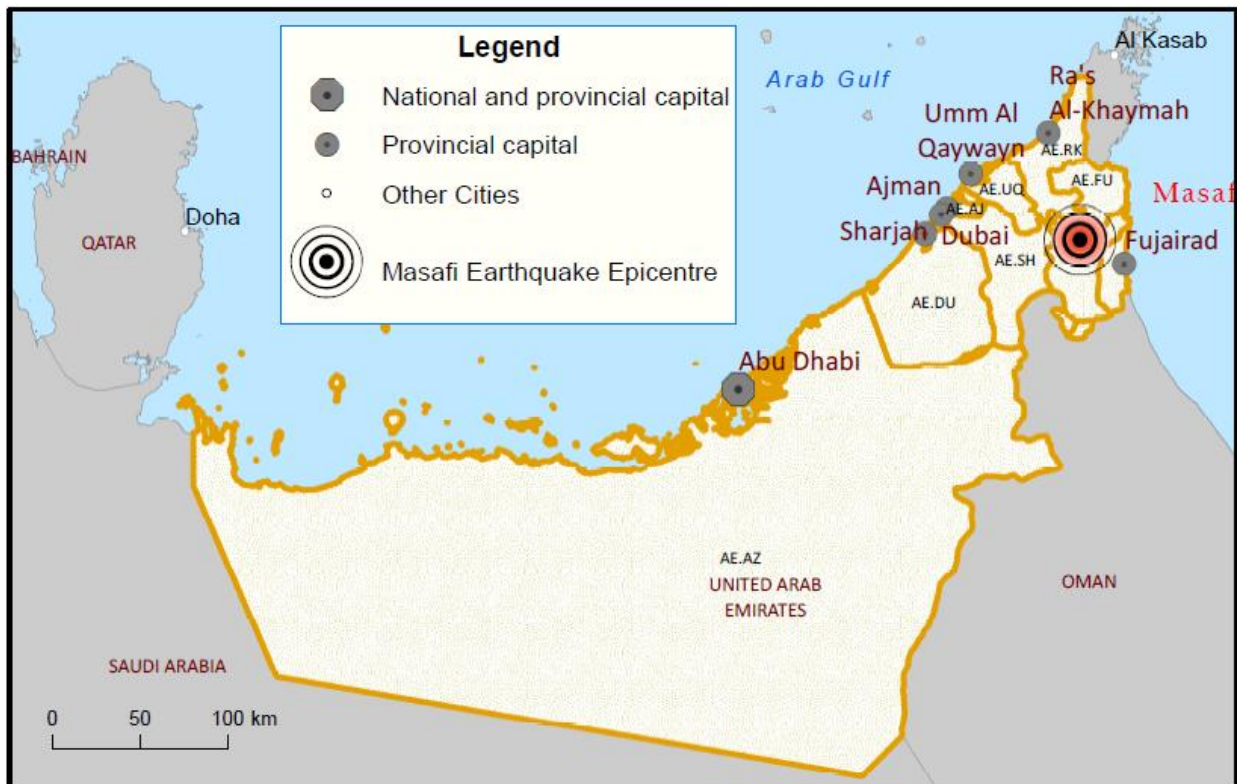
²¹² A. Kazmi, 'Risk of earthquake ruled out for now,' *GulfNews*, 28 October, 2005.

²¹³ R, Arthur, A. Fowler, M. Abdullah, & A. Al Enezi, 'The March 11 2002 Masafi United Arab Emirates earthquake,' *Tectonophysics*, 415, 2006; 57- 64.

²¹⁴ E. U. Zain & A. Fowler, 'Palaeostress reconstructions of the Wadi Ham Fault Zone Northern Oman Mountains United Arab Emirates UAE,' *The 6th International Conference on the Geology of the Middle East UAE*, University College of Science Geology Department, 2006.

01:00 A. M. when most families are usually in their houses asleep²¹⁵. The following maps illustrate Masafi's geographical location and earthquake magnitude.

Figure 25: Masafi Geographical Location



Ahmed Al Marzooqi 2017

²¹⁵ Dhanhani, p. 190

Figure 26: Masafi Earthquake Magnitude and Seismic HazardsSource: United States Geological Survey (USGS), 2008.



Since the earthquake was late in the night when neighborhoods are relatively quiet, it was possible to most people to describe the events. A resident in the area, during an interview stated that the previous night, there were 4-6 earth tremors, causing some houses to shake. Moreover, the Masafi village, being largely rural and inhabited with peasant farmers then, had significant noise²¹⁶ from the livestock such as chicken and sheep and the same noise was heard on the same night of the Masafi earthquake for 3 to 4 hours before 01:00 am.

The Dibba fault spreads for 100 km to link the Zagros fault systems. Therefore, the earthquake was concentrated towards the north where seismologists consider the waves were directed²¹⁷. The entire region from the Arabian Gulf spreading to the Iranian plateau is known for such active earthquakes, which normally cause deaths and destruction of

²¹⁶ Ibid

²¹⁷ A. Rodgers, A. Fowler & H. Tkalčić, 'Earthquakes and Seismic Structure of the United Arab Emirates,' *American Geophysical Union*, Lawrence Livermore National Laboratory L 205 7000 East Avenue, 2003.

property²¹⁸. According to the USGS, the Masafi earthquake epicenter was at 25.236 – 56.145, which implies that the Dibba faults were very active on the day²¹⁹. The following table illustrates the sources of Masafi Earthquake and times.

Table 15: Masafi Earthquake Location, Depth, Time and Magnitude

Catalog	Latitude	Longitude	Depth	Time	Magnitude
USGS-PDE	25.236	56.145	10	20:06:37.2	5.1(mb)
IDC-REB	25.2663	56.1009	0*	20:06:37.5	4.9 (mb)
KISR	25.23	56.13	10	20:06:37	4.6 (ms)
CMT	24.82	55.77	15	20:06:34.5	5.0 (mw)

Source: Rodgers et al., 2006.

Masafi earthquake covered majority of Fujairah with multiple shocks ranging M4 - M4.8 spreading to the rest of the region for a couple of days. Other regions aptly felt by the earthquake were Zagros facing Iran and adjacent to the UAE. Many people interviewed confirmed the impact of Masafi earthquake and a record number of structures were either cracked or collapsed due to its impact²²⁰. The following figure further illustrates the Masafi earthquake wave modeling.

²¹⁸ S. Dehqan, 'Iranians Living Near Fault Lines,' *Iran Daily Society* 07, 2009. Retrieved January 23, 2015, http://www.iran-daily.com/1388/8/21/MainPaper/3545/Page/7/MainPaper_3545_7.pdf

²¹⁹ Al Homoud, Ibid

²²⁰ A, Othman, F, Othman, J, Fawler & Bedh, A. *Impact of Fujairah earthquake study* University of Emirates Report, 2002; pp. 1-20.

Figure 27: Masafi Earthquake Waveform



Source: Rodgers 2005.

The response to the Masafi earthquake disaster was varied despite the finding that no one was injured. As soon as the noise from the loose rocks up the mountain was heard, the population became alert. However, various buildings and structures cracked due to the earthquake wavelength and forces. Indeed, many schools around Masafi including the structures at the Civil Defense developed some cracks depending on their proximity to the epicenter. The earlier practice of constructing houses using layers of rocks without compacting sand proved faulty with the earthquake wavelengths, and should have been architecturally condemned. Therefore, most of the building lacked seismic strength to overcome the earthquake²²¹.

An interview with senior government officials from Fujairah indicated that about 230 structures including mosques, houses and hospitals had cracks. The first to respond to the

²²¹ Othman et al., p. 3

Masafi disaster was the Civil Defence, who proceeded to order all residents to move out of the area, despite the lack of a policy or evacuation plan. Consequently, the people in Masafi town stayed out in tents for three days as the rescue officials assessed the situation. The rescue team was composed of the Ministry of Labour and Social Affairs, the Ministry of Housing and Public Works, the Ministry of Interior (Civil Defence) and the Ministry of Agriculture and Fisheries²²².

The rescue teams mandate included evaluation of the damage caused by the Masafi earthquake to all types of structures and estimation of financial compensation that is commensurate with the disaster. The Red Crescent was also involved in the Masafi disaster rescue efforts by providing tents and communication among families separated by distress. The Red Crescent was however criticized for delays in distributing tents to all the needy and in their defence; officials stated that such persons were late in making orders from the concerned departments. Other Masafi residents complained that the medical services were inadequate to cover the population and this could have resulted in a secondary disaster²²³.

After the Masafi earthquake disaster, there was a general shift in building and construction policy to be able to cope with the frequent seismic earth movements in the Fujairah area. Previously, construction of structures did not comply with the high standards for resisting earthquake events, understandably because there were few or no such events. Additionally, the laws and regulations governing buildings and constructions were not stringent to confront flimsy contractors.

The Masafi disaster was a wakeup call to the UAE on the potentials of earthquake disasters to construction structures and infrastructures. Hence, the UAE Ministry of Public Works constructed about 85 houses within the Fujairah area as part of the compensation for the residents who became homeless from the disaster. However, these houses have been constructed in the same geographical region and analysis is waiting to see if they could survive another seismic activity with similar range of magnitude.

A key lesson from the Masafi earthquake disaster is that part of the UAE lies in an area prone to seismic movements, occasionally escalated by events in Iran. Additionally,

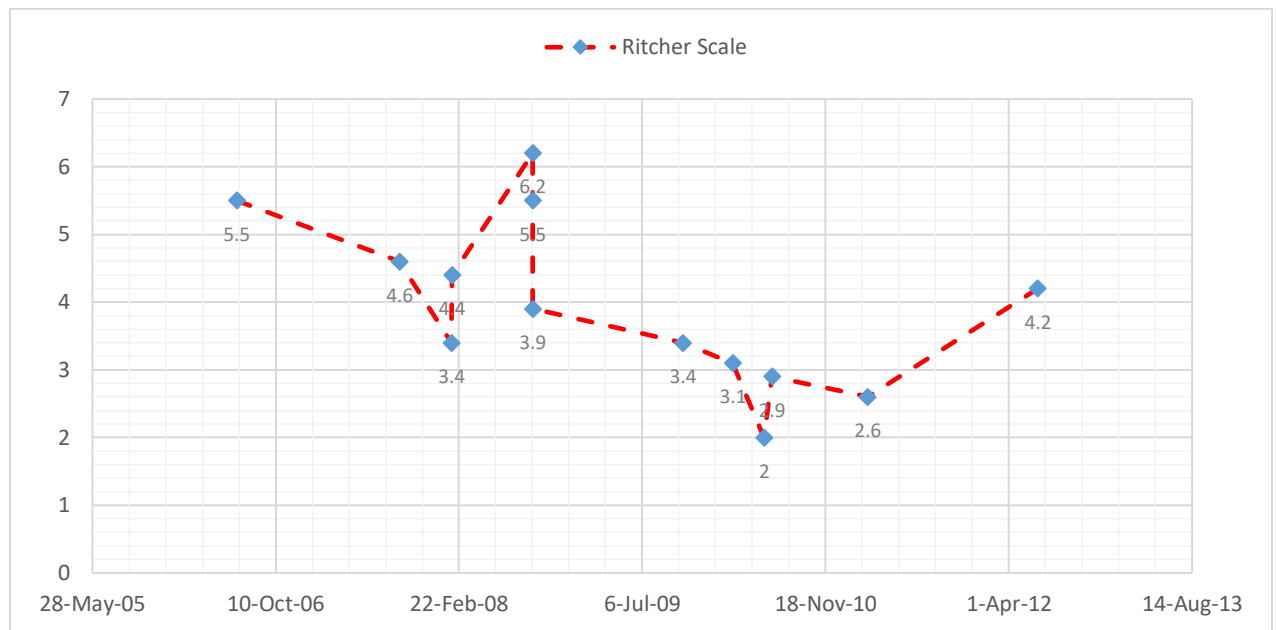
²²² Dhanhani, p. 192

²²³ Dhanhani, p. 192.

the Dibba faults that connects to the Zagros faults should be observed carefully and frequently for any potential earthquakes going forwards²²⁴. In fact, every time the Zagros faults show signs of significant wavelengths from the Iran side, the UAE should send warning to the residents in the most vulnerable locations²²⁵.

The following figure illustrates the trends of earthquake in UAE during 2006 to 2012²²⁶.

Figure 28: UAE Earthquake Trends



Source: Ahmed Al Marzooqi 2017

6.1.3 Al Tawaian Landslide Disaster of 2005

Al Tawaian – Dibba road connects with Emirate of Fujairah and is located at WGS84 and grid 416133E, 2825636N. By 2005, over 20,000 people were using this road daily. The new section of this road, constructed before the disaster, was 29.5 km for commercial commuting purposes. This road was about 22 meters wide to cater for traffic either way. This new road was a short-cut for a previous route of 80 km. Nevertheless,

²²⁴ H. Malkawi, *The Bam M 6.6 Earthquake of December 26 2003*, SE Iran Engineering Seismological Aspects & Implications for the UAE Seismology & Earthquakes, Arabian Gulf Region Forum 22-25 February 2004 University of Sharjah UAE, 2004.

²²⁵ M. Barazangi 'A Summary of the Seismotectonics of the Arab region,' In: Cidlinsky and Rouhban (eds), *Assessment And Mitigation of Earthquake Risk in the Arab Region* UNESCO , 1983; 43-58.

²²⁶ Khaili, K. A. & Patirage, C. *A Critical Review on Disaster Preparedness and Management of Emirati Energy Sector*. Issue 77, 2011; pp. 104-121.

the new Al Tawaian – Dibba road was constructed from some of the most rugged and tough terrains in the Emirate of Fujairah. The road region is very raised from others and strong winds from the hills and temperatures reaching 50°C were always a concern²²⁷.

Some of the outstanding features surrounding the Al Tawaian – Dibba road were gullies, which widened with every rainstorms washing down with gravity and through the land, leaving very steep valleys. Consequently, a lot of construction material and labor was used in the Al Tawaian – Dibba road to bring it to required standards and support the weight of the heavy commercial vehicles. The Al Tawaian – Dibba road construction skipped the original starting date in 1998 to mid-2001 due to these challenges. The Al Tawaian – Dibba road was eventually completed in late 2003 at USD 45 million. Most of the Al Tawaian – Dibba road construction financing was from the Ministry of Public Works. The lead consultants' engineer for the construction was Jacobson Gigg, while the contractors were national Wheel J&P from Cyprus²²⁸.

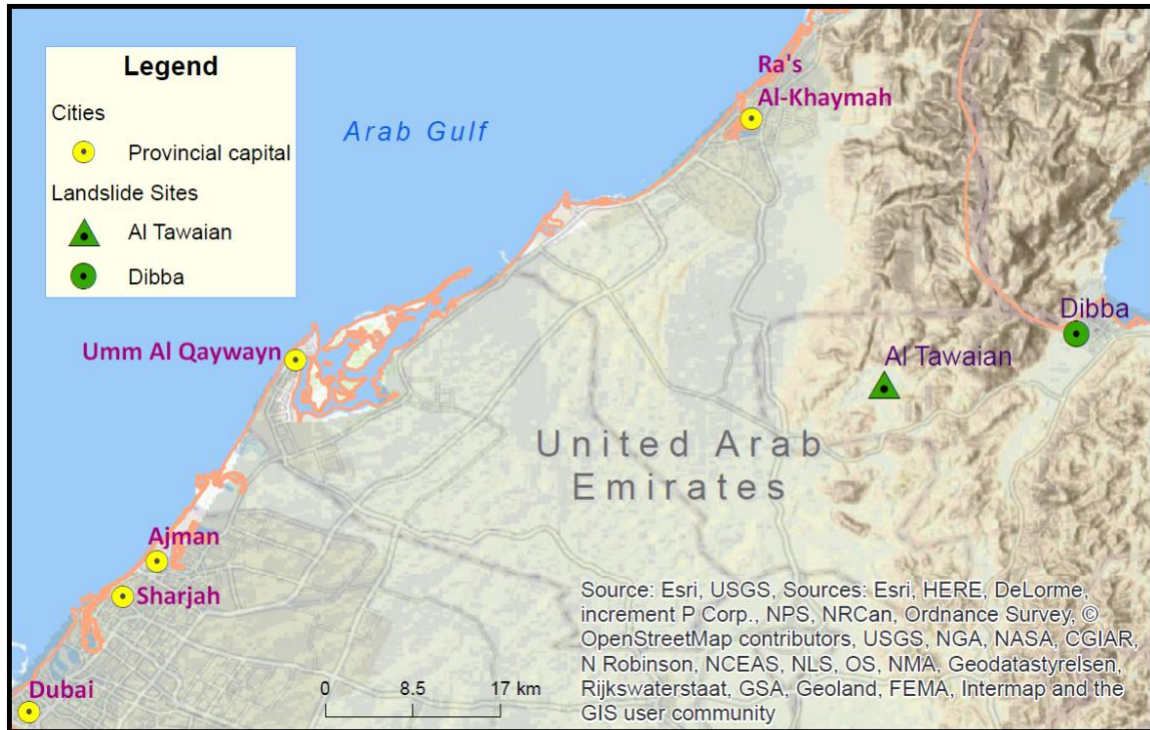
After illustrating the location of the Al Tawaian – Dibba road, it is important to explain how a landslide occurs and its disaster potentials. Most landslides occur when wide plates of land sink downwards and outwards simultaneously due to state of the underlying rocks, soil or surface covers, often due to gravity. Some landslides occur with speed, while others are slow over a long period. In terms of surface stability, landslides are a hazard because they eventually change the landscape at hilly or mountainous regions. Where the landslide takes place rapidly²²⁹, the structures on the surface whether roads, rails, houses, schools, airport among others can crumble and result in injury, losses in assets, breakdown in communication and logistics.

²²⁷ Ministry of Public Works Personal interview, 2008.

²²⁸ Ministry of Public Works Personal interview, 2008.

²²⁹ Smith, K. *Environmental Hazards Assessing Risk and Reducing Disaster*, 4th edition Routledge 259 – 288, 2001.

Figure 29: Al Tawaian Map and Site of Landslide



Source; Ahmed Al Marzooqi 2017.

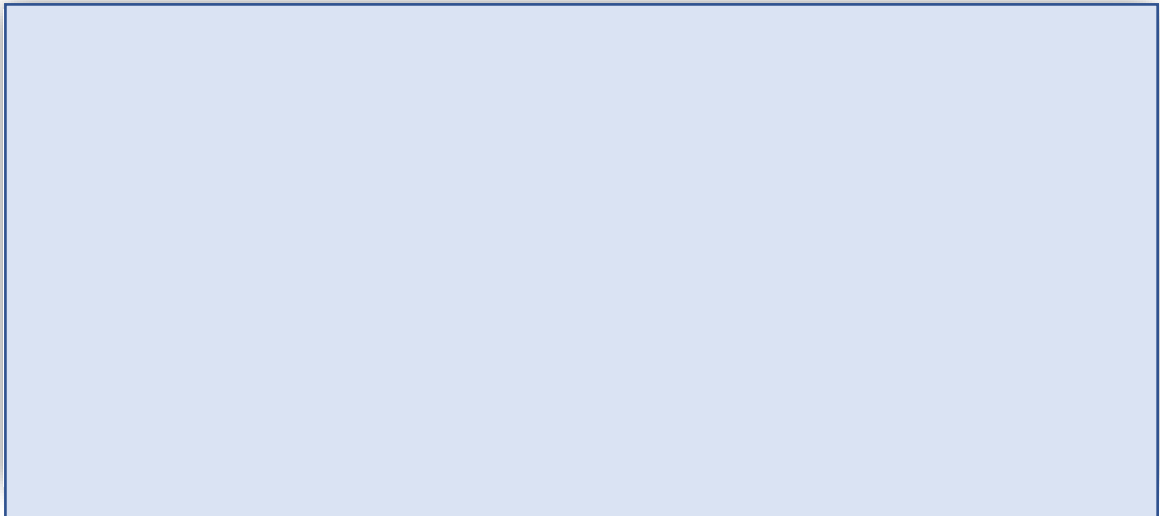
It is important to state that landslides are surfaces in motion, whether rocks or soil plates. Therefore, some land surfaces are displaced depending on the direction of pressure or looseness of soil materials. The linkages between the rock and soil stress and the cohesion of the soil density coupled with the degree of slope, depth and friction all determine the speed and intensity of landslides. Therefore, different landslides across the world vary in casualty, destruction and degradation of landscapes²³⁰. Most of the risky landslides are caused by water logging, often from rains. Other factors that hasten landslide movements are earthquakes, tremors, volcanic activities and flash floods. Similarly, certain human activities like rapid deforestation and construction of big structures or infrastructures in regions vulnerable to landslides are sure way of aggravating the situation. Even mining and explosion of quarries is known to cause landslides in many regions across the world²³¹.

²³⁰ Smith, p. 170.

²³¹ Javier, H. *Lessons Learnt from Landslide Disasters in Europe* EUR 20558 EN European Communities, Italy, 2003.

The Al Tawaian-Dibba landslide occurred on the March 19, 2006 precisely, after the region was pounded by rains for 3-4 days. Consequently, some large rocks dropped from nearby slopes onto the Al Tawaian-Dibba new road at about 9am. Most of the road was blocked for half a year. On the fateful day, other smaller ones for hours accompanied the huge rock drop. Initially, Halcrow was the lead consultant to establish the triggers of the landslide including the entire survey and mapping of the area. This study commenced from the initial landscape design before any construction started. The outcome of the study was compiled to reveal the possible triggers of the Al Tawaian-Dibba landslide²³². The following photo shows an image of the Al Tawaian-Dibba Landslide site.

Figure 30: The Al Tawaian-Dibba Landslide



Source: Dhanhani, 2010, p. 196

The geological investigation revealed that the Al Tawaian-Dibba landslide was in the ‘Dibba Zone’, which is embedded with ancient Jurassic sedimentary rocks, probably 200-100 million years old. These are surfaces having medium coarse texture with mix of limestone and mudstones. Moreover, the investigations established that the Dibba Zone was vulnerable to seismic forces from the upper regions. These movements had caused the ocean base rocks to fault upwards and displace the continental rocks. Systematic rock

²³² Ministry of Public Works Personal interview, 2008.

movements over the years have resulted in multiple faults and folds in the Dibba Zone as shown in the images below²³³.

Figure 31: the Al Tawaian-Dibba Limestone and Shale



Source: Halcrow 2006 cited in Dhanhani, 2010, p. 198.

The response to the Al Tawaian-Dibba landslide started with the local police blocking the entire road for about seven days as an alternative diversion was prepared. Additionally, the Ministry of Public Works (MOPW) consulted Halcrow to investigate the disaster and recommend the best way forward. The study of the factors of the Al Tawaian-Dibba landslide included extensive material reviews. A historic report from the MOPW about the initial road design that was supposed to commence in 1998, was reviewed if there were any gaps towards the actual construction works of the Al Tawaian-Dibba road²³⁴.

²³³ Halcrow, *Tawaian to Dibba Road Landslide* Halcrow, Middle East Final Report, July, 2006.

²³⁴ Halcrow, 2006.

Figure 32: The Al Tawaian-Dibba Steepy Limestone and Shale



Source: Halcrow 2006 Cited in Dhanhani, 2010, p. 198.

The outcome of the Halcrow investigations established that the Al Tawaian-Dibba landslide was caused by serious ground instability in the area's geological design. Even though the Al Tawaian-Dibba road designers attempted to maneuver through the difficult terrains, it appears the construction work was lacking in some attention to details. Specifically, the contractors failed to compact the surface over rudimentary rocks; hence, the Al Tawaian-Dibba road was very unstable. Whereas the duty of the engineer was stipulated as far as road design is concerned, there was no clarity on who was to ensure the slopes along the road are stabilized to minimize sliding forces²³⁵.

It was understandable that the slopes were weak due to mechanical method of excavation. However, since the contractor had prior knowledge of the sliding rocks during the initial cutting of the slopes, this experience should have informed greater attention in stabilizing the same. To some extent, the contractor's skills in handling the rocks excavation were questionable, because the rocks in this area proved quite challenging from their geological instability and the degree of slopes. During the process of reconstructing the Al Tawaian-Dibba road, the UAE MOPW took extra precaution to appoint a more qualified engineer with excellent supervisory skills to redesign and re-cut the slopes afresh. The new design was able to survive significant landslides occasioned

²³⁵ Dhanhani, p. 199

by rainstorms or winter at the slopes of Fujairah Mountains²³⁶. The following figure illustrates some of the Al Tawaian-Dibba road reconstruction processes with (a) the previous road before landslide; (b) part of the road's slopes after landslide; (c) the slopes reconstruction process; (d) new slope designs.

There are very important lessons from the Al Tawaian-Dibba road landslide. Initially, the UAE government under the MOPW used US \$45 million for the project. However, after the landslide disaster, the government spent more to redesign and rebuild the slopes and make them more stable and to overcome future earth movements. Ordinarily, very many people pass through this road before the landslide disaster as it links Dubai and Abu Dhabi. However, once the landslide caused closure of the road, the same commuters were inconvenienced and many other sought to use the old longer route of more than 80 km journey. Another lesson from the shoddy construction work was that the Al Tawaian-Dibba road was shut for over six months until November 2009. By 2010, some light maintenance work was still ongoing at the stretch. Whereas there were no fatalities or injuries in this disaster, the loss of time and extra financial expenditure are the most fundamental lessons from the disaster²³⁷.

6.1.4 Tropical Gonu Storm Disaster of 2007

Whenever cyclones and storms occur in land, there are accompanied by heavy downpour, gales and often leave a trail of destructions to houses, plants and machineries especially within the residential areas. If the cyclones commence their activities from the Caribbean Sea, Gulf of Mexico, Pacific Coast of Mexico and North Atlantic, there are referred to as hurricanes. However, if the storms start from the Western Pacific Ocean, Australia and over the Indian Ocean, they are called Typhoons. This systematic naming commenced in 1940 accompanied by a female name. Later in the 1980s, the system included male names²³⁸.

The Tropical Gonu storm caught everyone in the Arabian Gulf by surprise, because similar storms have historically been appearing in the North of Indian Ocean and Bay of Bengal. For a long time, the Arabian Gulf had not experienced such storm and cyclone.

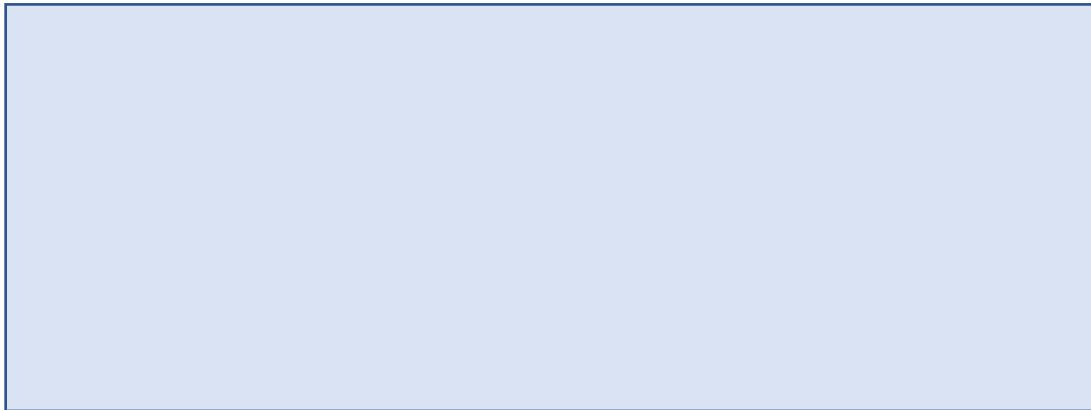
²³⁶ Dhanhani, p. 200

²³⁷ Dhanhani, p. 201.

²³⁸ Alexander, D. *Natural disasters* Routledge, London, 1993.

The closest were some feeble storms sweeping across the Arabian Peninsula. Therefore, the event of the tropical Gonu was classified as exceptionally forceful across the Arabian Peninsula for over three decades²³⁹. The onset of Tropical Gonu storm from 4-5 June 2007 is still very memorable in the minds of people around the Oman coast as shown in the NASA photo below.

Figure 33: Tropical Cyclone Gonu by NASA QuikSCAT



Source: NASA, 2007.

As the storm proceeded, as shown in the NASA photo above, there was heavy rainfall with maximum of 1000mm recorded in Oman alone and escalating to flooding all over the place²⁴⁰. The entire Capital of Oman at Muscat was awash with the floods, weak buildings were collapsing, vehicles were overturned, trees fallen and the electrical and telephone supply disrupted for days.

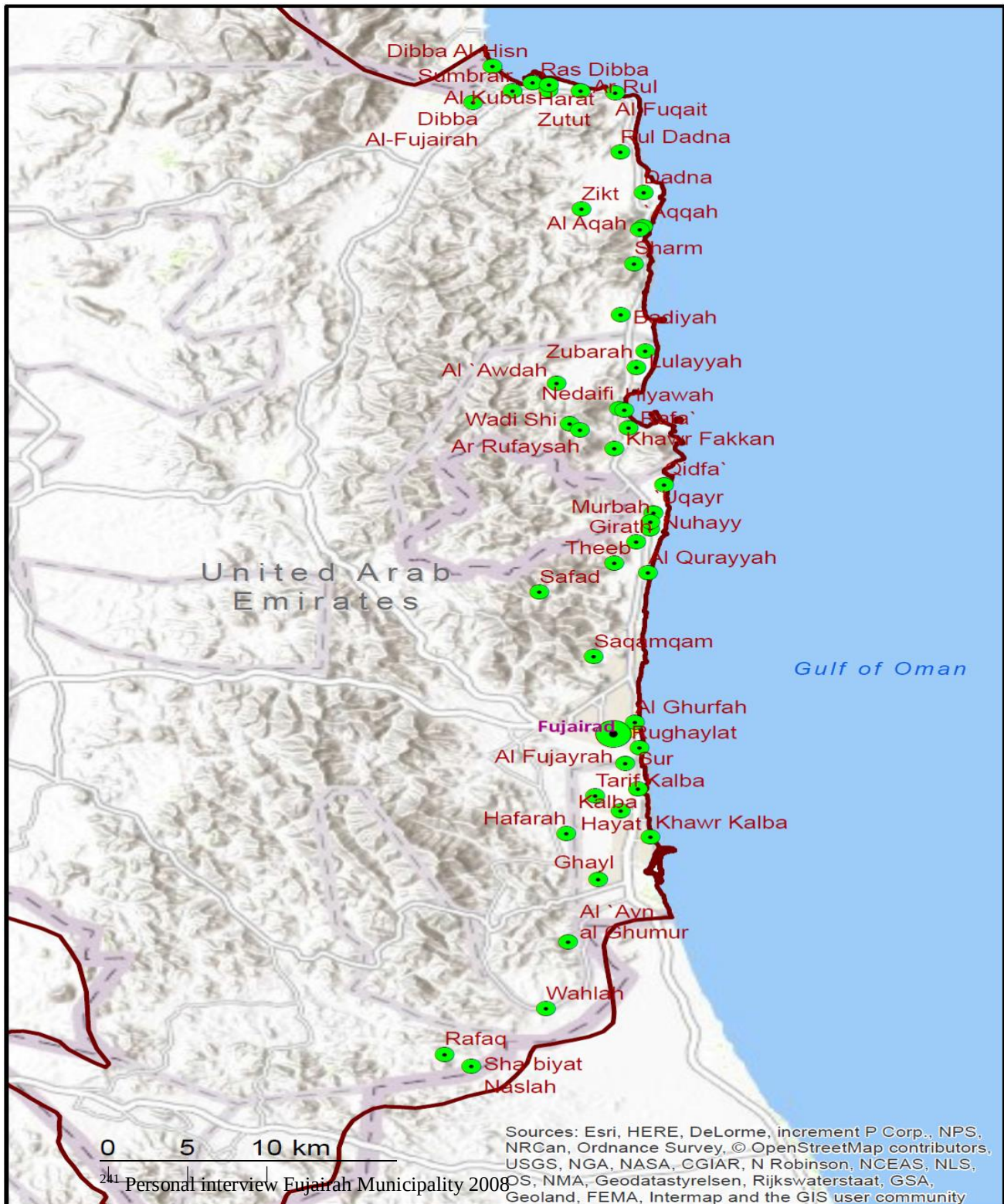
Several places adjacent to Oman excommunicated due to the flood conditions. The Moserah Island and Muscat areas were particularly affected. Huge parts of the Emirate of Fujairah and sections of Sharjah were not spared by the events of the storm, whereby the winds reached about 160 mph (260 km/h). With this kind of storm, it was understandable that huge sections of Sharma, Suhilah and Al Bedyah were affected. As the flood levels rose higher, the streets closed down, the public degenerated into pandemonium, tourists

²³⁹ NASA, Tropical Cyclone Gonu Observed by *QuikSCAT*, 2007, Retrieved January 24, 2015, <http://photojournal.jpl.nasa.gov/catalog/PIA09600>

²⁴⁰ El Rafy, M. & Hafez, Y. Anomalies in meteorological fields over northern Asia and its impact on hurricane Gonu, 28th Conference on Hurricanes and Tropical Meteorology. *American Meteorological Society* 9B5, 2008

and residents began to evacuate for their safety²⁴¹. The following map shows the affected sections by the Tropical Cyclone Gonu.

Figure 34: Areas Affected by Tropical Cyclone Gonu



Tropical Cyclone Gonu was Class 5 Storm and ranked among the most disastrous around the Arabian Sea and North Indian Ocean for the decade²⁴². Accounts by residents in the area faced by the storm stated that hundreds of people lost their lives, yet corroborated evidence of the exact figures were elusive from the government and the rescue officials in the initial days. Later, a government spokesperson clarified that only 50 bodies were retrieved, 27 reported missing and over 20,000 internally displaced from their residential places. The local medical facilities could not cope with the high numbers of injuries and traumatized residents aside from their operations affected by lack of clean water and electricity, disrupted by the raging floods²⁴³.

All the people living around the shores were ordered to vacate because of the rising sea levels and the fierce storms. There were unusual waves around the coastline around the coastlines of Fujairah reaching 5-5.5 meters while those in Suhilah & Sharm reached 5 meters. The MOPW estimated the damage from the Tropical Cyclone Gonu at \$600 million²⁴⁴.

Within the Emirate of Sharjah, the Gonu storm caused damages and losses in the following proportions: Suhilah 85%, Sor Kalba 14% and Khor Kalba 1%. Additionally, within the Emirate of Fujairah, the following losses were encountered: Sharm & Al Bedyah – 64%; Al Regelat and Al Faseel – 20% and Merpeh and Qedfee – 15%²⁴⁵.

There were reports that the UAE government had prior knowledge of the onset of Tropical Cyclone Gonu and had actually declared a state of emergency among inter-agencies within Emirate of Fujairah. There were specific indications that the storm would approach from the coastlines. Therefore, within hours of the storm, the national police and army service persons were on alert and within sight. The entire region's airports and seaports shut down as planes and ships diverted to other places and await the storms to calm down²⁴⁶.

²⁴² Ali H, B., Ashrafi, R., Ali, O. & Al Majeeni, P. 'IT disaster recovery Oman and Cyclone Gonu lessons learned,' *Information Management & Computer Security* 2, 2009;pp. 114- 126.

²⁴³ El Rafy & Hafez 2008.

²⁴⁴ MOPW, 2007.

²⁴⁵ MOPW, 2007.

²⁴⁶ Dhanhani, p. 206.

The Red Crescent ensured that all the learning institutions were safe and ready to accommodate internally displaced persons. The Red Crescent was highly activated from various inter-agency meetings involving key government ministries. The Red Crescent's duties included distribution of relief products and construction of temporary tents at high grounds. More than 500 people benefited from the Red Crescent evacuation especially from the Kalba area, which was worst hit by the floods. Many residents who spent the first night out in secured nearby schools were later moved to the Institute of Applied Technology in Fujairah. However, as the facility became overpopulated, other evacuated people had to keep shifting to other places with enough food and resting rooms²⁴⁷.

Sections of the rescued residents accused the UAE government for ineffective dissemination of the information about the impending storms. The residents claimed that the media who were trying to assure them not to worry also watered down the government early warning messages. Hence, many residents in the Fujairah were rather caught by surprise when the Gonu storms hit the area. The media was blamed for failing to offer the public extra precaution information and materials to step up their vigilance for any possible storm hazards, include the safe zones to evacuate in time. The National Weather Service in the UAE was slow in their communication with the relevant government agencies and ministries about the potential threats and hazards of the Gonu storm, aside from rescue teams' revelations that many residents hesitated to evacuate from their homes²⁴⁸.

The level of mobilization of the UAE's Civil Defence was inadequate as many people felt that their collaboration with the police gave an impression of a military rather than an emergency operation. Over the years, the military forces in the UAE have been used during such emergencies and their performance has been less than satisfactory in the disaster handling. The problem is that most military command systems are better trained for combat disaster management rather than civilian emergency interventions²⁴⁹.

During an interview with affected persons who were within the Sharm when the Gonu storm struck, there were complaints that the government could have done more with the satellite images showing the advancing cyclone and storms. These people stated that if

²⁴⁷ Dhanhani, p. 206.

²⁴⁸ Dhanhani, p. 206

²⁴⁹ Dunia 2007

the government provided the information timely and with clarity of the severity of the impending storms, they would have been able to move with their valuable properties. Other complained about the rescue agencies delaying to remove dead persons' bodies from buildings long after reports were made. A more coordinated approach towards the disaster would have minimized the damages and losses. However, gaps in information lead to the many affected people fighting for their own survival. Sections of the public regarded the discrepancy on the number of dead people as failed transparency between the Ministry of Information and the emergency coordinating teams²⁵⁰.

Immediately after the storms calmed, the Dibba and Fujairah Municipalities commenced the recovery and reconstruction services respectively. The MOPW worked on damaged roads and unblocked drainages. Normal transport along the main roads in Fujairah resumed after two days of inter-agency work to clean up places. Power lines partially shut down in sections of the Fujairah were restored by the second day²⁵¹.

On 14th June, the UAE Ministry of Education (MoE) mobilized students to support the cleaning exercise and remove debris from various social amenities. The students also assisted Red Crescent to improve their clothes, food and drinking water distribution to the needy people. The UAE government managed the entire Tropical Gonu Storm aftermath without enlisting support from international relief groups as they asserted that the situation was under control²⁵².

There are a couple of important lessons from the Tropical Gonu Storm management processes. Whenever the public do not have adequate information or early warning about upcoming emergencies, they often view the government as failing in transparency. In this case, the public could not mobilize to evacuate efficiently because of the mixed signals about the seriousness of the Gonu storms. Additionally, when the public have sufficient awareness about such emergencies, they stand a better chance of responding to authorities' instructions for evacuation. The UAE disaster management system needs this review to ensure the response has better coordination²⁵³.

²⁵⁰ Dhanhani, p. 207 – 208.

²⁵¹ Dhanhani, p. 208.

²⁵² Dhanhani, p. 208.

²⁵³ Dhanhani, p. 209.

It is crucial for the disaster rescue teams to carry out regular drills to test and ensure that shelters are workable and safe for use when the real scenario arises. The disaster management team in UAE needs a central command structure that issues instructions to activate and deactivate operations. The same team must have adequate safety and support materials to make their work more efficient. Moreover, regular training of different disaster management team members will ensure they are up to the task as need arises. A key area that seemed to be challenging the rescue teams was planning and task allocation to avoid wastage of resources or duplication of duties²⁵⁴.

Going forward, if the Fujairah Civil Defence is going to be engaged in future disaster management processes, then a course needs to be introduced in their training colleges. Moreover, the Ministry of Defence needs to document their specific roles in such disasters because previously, many reports of confused commands were reported. The Fujairah Civil Defence needs to do joint rescue drills with other emergency rescue teams so that proper planning protocol can be established²⁵⁵.

During the Gonu storm emergency, the UAE had sufficient food stocks to feed all the affected families and individuals. However, the distribution networks and coordination were duplicated, whereas the extra work force could have been channeled to rescuing people from harm's way. For example, Red Crescent and the Ministry of Social Affairs were both engaged in providing temporary tents and food aids together with some unnamed volunteers. Eventually, some families had more than necessary supplies while others were in dire shortage. Moreover, various NGOs had duplicate roles and arrived to the evacuation region without informing those already at work²⁵⁶.

The Gonu storm disaster illustrated the lack of capacity by some rescue organizations to respond promptly, with special equipment and facilities even when some of these are already available with the residents. Coupled with the gaps in the early warning systems, it is clear why the people in the affected areas were slow to respond. In many cases, the mixed information signals lead to indecision about why and when to evacuate houses and other vulnerable buildings. Whereas good size of population had prior information of impending Gonu storm, they were uneducated on its risks and its hazardous potentials.

²⁵⁴ Dhanhani, p. 209.

²⁵⁵ Dhanhani, p.210.

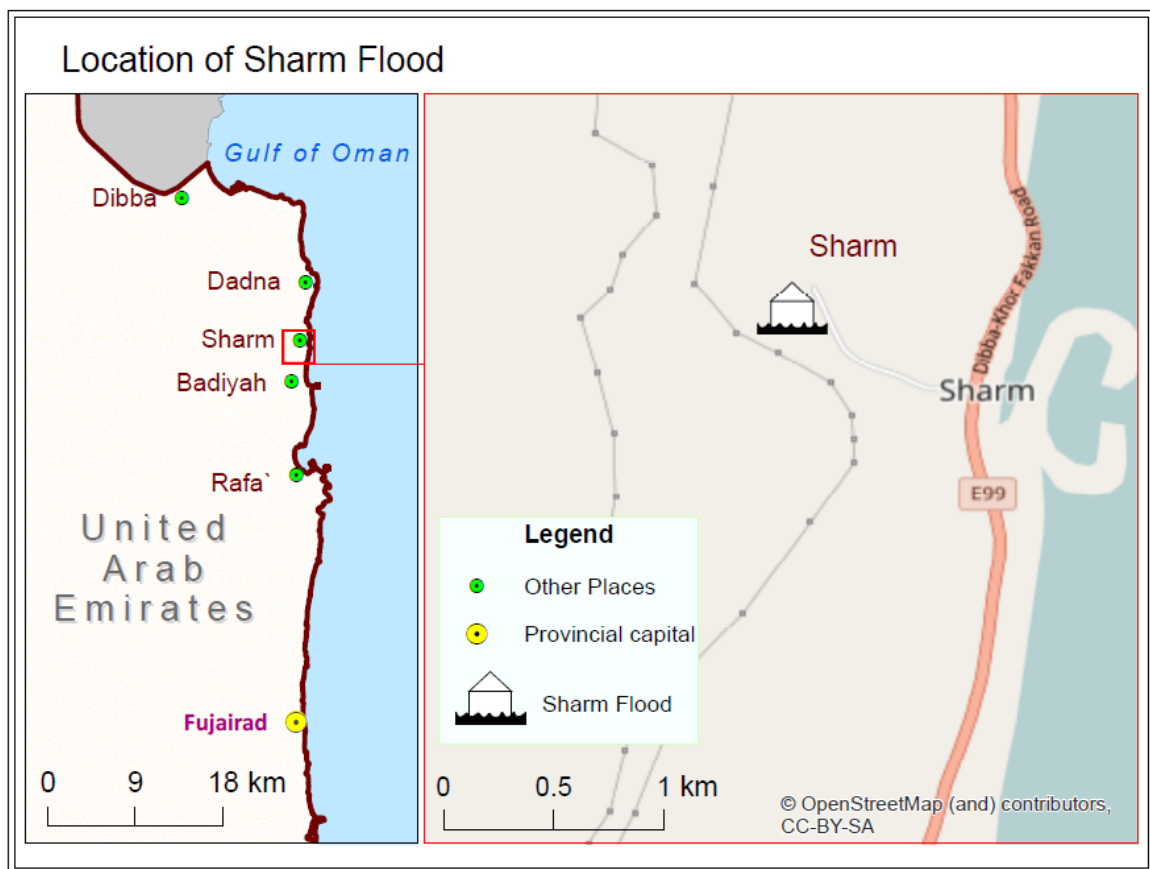
²⁵⁶ Dhanhani, p. 210.

The Fujairah Civil Defence²⁵⁷, albeit untrained for such magnitude of emergency, must hone their capacity and maximize the use of their facilities and equipment next time, because the instances of confusion witnesses are avoidable next time when duty calls within the UAE.

6.1.5 Sharm Flood Disaster of 2009

Sharm town is within the Emirate of Fujairah at 25° 28 7N – 56° 21 37E, towards the northern frontiers. Sharm is further 20 km to Dibba and 50 km to Fujairah City, facing the Indian Ocean beaches and is to the East of Arabian Peninsula. By that time of the floods, Sharm had just over 2,500 people residing in more than 120 buildings²⁵⁸. The map below illustrates the location of Sharm.

Figure 35: Location of Sharm Flood



Source; Ahmed Al Marzooqi 2017

²⁵⁷ Dhanhani, p. 210.

²⁵⁸ Personal interview Fujairah Municipality, 2009

Frequently, heavy downpours within the UAE often lead to flash floods across the landscapes. However, during the heavy rain season, on 23rd March 2009, the Sharm region was pounded by south-easterly storms accompanied by lightening. The runoff was so much that the dams at Sharm could not contain the water volumes and force. Obviously, the dam was supported by weak construction mostly earth, hence, the problem. Water rushed through the town, farms and streets sweeping anything on its way. The entire town was contaminated with debris and silt with the flood damage estimated at millions of dollars²⁵⁹.

During Initial emergency response, intervention by the Fujairah Civil Defense and Police managed to bring the situation back to control. However, the coordination had problems because the logistical supplies could not reach all the needy people in time and quantity²⁶⁰.

Next, a state of emergency was declared to enable the different agencies mobilize resources and work force towards relief. The Red Crescent responded to the emergency once again and people were evacuated to safe hotels and buildings that are raised and free from the advancing floods. The Red Crescent also managed to mobilize additional volunteers to beef up their staff numbers and ensure all families have enough food and drinking water. The combined efforts between the Fujairah Defense Forces and the Red Crescent saved many lives including families on the rooftops, in vehicles and other elevated positions. There were sufficient tents, food, warm covers and other rescue logistics at places where Red Crescent had set up camps in advance²⁶¹.

The evaluation of the losses post Sharm floods revealed that many resident's lands were water logged, crops destroyed and their commuting subjected to boating for several days. At least 30 residential buildings, 2 mosques, 10 agricultural lands and 10 vehicles were lost due to the Sharm floods²⁶². The road networks from Dibba and Khor Fakkan

²⁵⁹ Dhanhani, p. 211.

²⁶⁰ Fujairah Statistical *yearbook* Tenth issue, Fujairah, 2007.

²⁶¹ Dhanhani, p. 212.

²⁶² Hasan, A. & Mekawee, A. 'Intensive efforts of the federal institutions and local communities to support those Loss of 20 houses and 10 farms and 6 mosques in Sharm and the Eastern Region,' *Gulf News Akbar Al Dar* 23/3/2009.

were temporarily shut as the floods reduced the drivers' visibility to risky levels. Most roads had water up to 1 m deep and this was very unsafe to attempt to drive around. Many motorists had to leave their vehicles to be towed to safety by the rescue teams. Besides the roads, most houses were muddy as debris covered the entire properties and ways making movement very difficult. Over 50 households were completely devastated by the floods within the Sharm area with damage estimated running into tens of millions of dollars. Sharm town was particularly vulnerable to the floods because of its low altitude compared to the dam. Therefore, the rescue teams also suffered from the difficulties of accessing the area once the floods broke the dam's banks²⁶³.

The authorities indicated that the Sharm floods were from torrents of rain whose runoff could not be contained by the existing dam structures. However, the UAE government never indicated the actual damage from the floods. Under normal circumstances, the residents of Sharm rely on sea fishing and subsistence farming to support their families. These occupations were most attractive to the older persons and less educated Sharm residents who could not get white-collar jobs. Most of the residential homes around Sharm have been in existence for over three decades and due to their income status, many owners or dwellers have not been able to maintain them. Some Sharm residential areas have poor sanitation and drainage, hence, when the opportunistic floodgates were opened, the disaster scale spread very fast. Some manageable floods have historically been reported during the winter seasons and sometimes the weather extremes lead to drought. The Sharm flood disaster was a demonstration that the relevant authorities have not taken the smaller occurrences seriously as some errors such as need to maintain dams were very avoidable. Going forward, any major construction works in Sharm are that do not have risk assessment should be delayed until when this condition is achieved to avert future possible disasters in the UAE²⁶⁴.

6.2 The Lessons Learned and Path Forward

As the population of the UAE, Abu Dhabi and GCC continues to increase, the authorities should expect that some types of disasters could lead to more deaths.

²⁶³ Dhanhani, p. 212.

²⁶⁴ Dhanhani, p. 213

Particularly the floods and cyclones should be watched carefully because these have proved to be very rapid in taking toll of people's properties and lives. Moreover, as more people venture to jobs in UAE that have significant vulnerability to hazards, there are expectations that the impacts of natural disaster could multiply many folds²⁶⁵.

The experiences from the handling of past disasters in the UAE by the Fujairah Defence Force in collaboration with the Fujairah Police should inform emergency rescue teams that a more coordinated approach is favorable. The communication gaps and duplication of roles experienced in the Al Qurayah floods in 1995 and the Gonu storm of 2007 are not expected to recur in future. Additionally, all middle to big size constructions in the UAE must pass high standards of architectural designs and risk assessment before work can begin. The UAE needs to limit some activities that tend to elevate the environmental risk levels to near disaster. For example, it is noteworthy that the Fujairah area of the UAE has about 70 major quarry mines, whose excavation is continuously shaking the grounds and weakening nearby infrastructural stability²⁶⁶.

If the UAE can limit the mushrooming of unplanned structures and buildings, then the natural disaster damages and losses can be reduced. From the previous section analysis of natural disaster impacts, it was evident that many people living in the Emirate of Fujairah specifically were setting up structures without prior knowledge or regard for their vulnerability to natural disasters. Various cases such as the housing schemes at Masafi reveal that no proper planning and authorization was accorded to the people. Moreover, future expectations are that further construction efforts at the Masafi Al Beledah, Al Qurayah, Dibba and Al Tawaian will conform to designs that can withstand earthquakes²⁶⁷.

This chapter has demonstrated that Emirate of Fujairah is the most vulnerable to natural disasters going by the historic documented events. Therefore, future expectations are that additional government research and resource mobilization will be targeted towards this area to minimize the natural disaster impact of the floods, earthquakes, landslides and storms. Additionally, continuous tracking of the seismic movements

²⁶⁵ Fujairah Statistical *yearbook* Tenth issue, Fujairah, 2007.

²⁶⁶ Fujairah Statistical *yearbook* Tenth issue, Fujairah, 2007.

²⁶⁷ Dhanhani, p. 214.

should be able to provide early warning to residents where location is most vulnerable. Even if the UAE government machinery is unable to state the exact time for the next disaster, previous knowledge about active faults and folds for more than a century and frequency of earthquakes of Magnitude 5.5 – 6.5 should be able to inform project types and appropriate consultation and designs²⁶⁸. Ideally, the following is the sequence that the UAE government should follow for natural disasters management.

Around the UAE, there have been preferences for people to construct small dwellings, most of which are more than three decades old. However, from the previous section, it was established that these sizes of structures are extremely vulnerable to disasters such as floods, earthquakes and tremors according to the frequency of occurrences at Emirate of Fujairah. Future expectations are that the government will make special considerations for key construction facilities such as learning, medical, security, Ministry buildings and Mosques to have to be bigger and stronger designs that can withstand natural disasters like floods, earthquakes, landslides, earth tremors and others²⁶⁹.

The UAE should adopt the same high standards of evaluating infrastructures like bridges, roads and railways and buildings for their seismic risks because sections of the UAE have proven to have very frequent related disasters. These facilities are further vulnerable to natural disasters from the strains of growing population and lack of proper service or maintenance. Lack of proper planning of buildings and facilities at sites with no prior survey is a practice that the UAE must curtail going forward because this too increased vulnerability to natural disaster risks. The existing land maps of the UAE also require regular surveys²⁷⁰, where seismologists are involved to show which areas have lately become active in faults and folds, rendering construction of buildings or infrastructure high risk to the users²⁷¹.

It is clear that the people of UAE have close cultural lives where big families live together, mostly in the same house. Therefore, the common practice is for the sons or siblings to subdivide existing house space into smaller units to accommodate more

²⁶⁸ Dhanhani, p. 215.

²⁶⁹ Dhanhani, et al., p. 65

²⁷⁰ Dhanhani, et al., p. 66

²⁷¹ Dhanhani, et al., p. 66

people. However, this practice can be counterproductive because any unsupervised reconstruction weakens the original structures and increases its vulnerability to risk from natural disasters. Majority of such extended reconstructions of buildings in the UAE are unauthorized by the relevant government bodies and this often shifts the burden of responsibility to the owners incase natural disasters strike²⁷².

History has proved that Fujairah is extremely vulnerable to natural hazards targeting social, economic and environmental balance. Other than the assertions the increase in population is partly responsible, there are other factors such as human development index characterized by the speedy urbanization. Therefore, buildings are coming up from all quarters and majority have poor planning, lack engineering input, no consideration for infrastructure like electricity, water, sewerage drainage, congestions and other multiple hazards. This is evident every time the government reconstructs buildings previously brought down by disasters, there is more orderliness. In future, the government of UAE will need to reinforce review and reinforce the building codes so that vulnerability to natural disaster minimizes²⁷³.

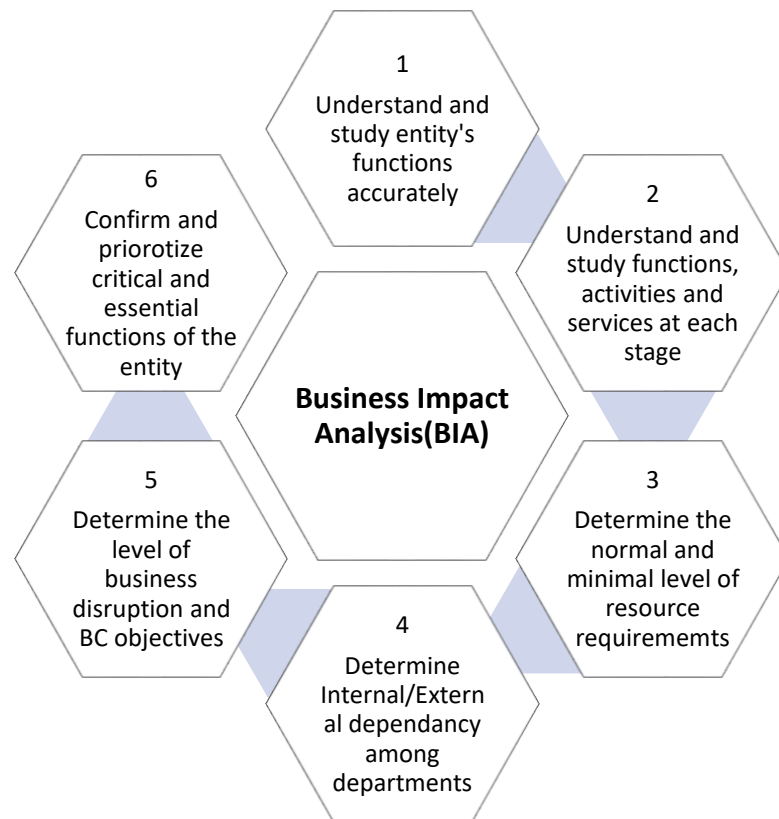
In future, the UAE needs to improve the networking among the natural disaster rescue agencies to minimize damages and losses. This clarion call arises from the multiple observations that some natural disaster response teams were either duplicating roles or ineffective in specific tasks. The objective of any disaster rescue effort is to reduce stress levels and suffering to the people before salvaging property. Even if natural disasters are sometimes unpredictable²⁷⁴, most have warnings, which authorities must project to the vulnerable people to prepare themselves and possibly get out of harm's way using the following cycle.

²⁷² Dhanhani, et al., p. 67

²⁷³ Dhanhani, et al., p. 68

²⁷⁴ Dhanhani, et al., p. 68

Figure 36: Natural Disaster Business Impact Analysis Cycle



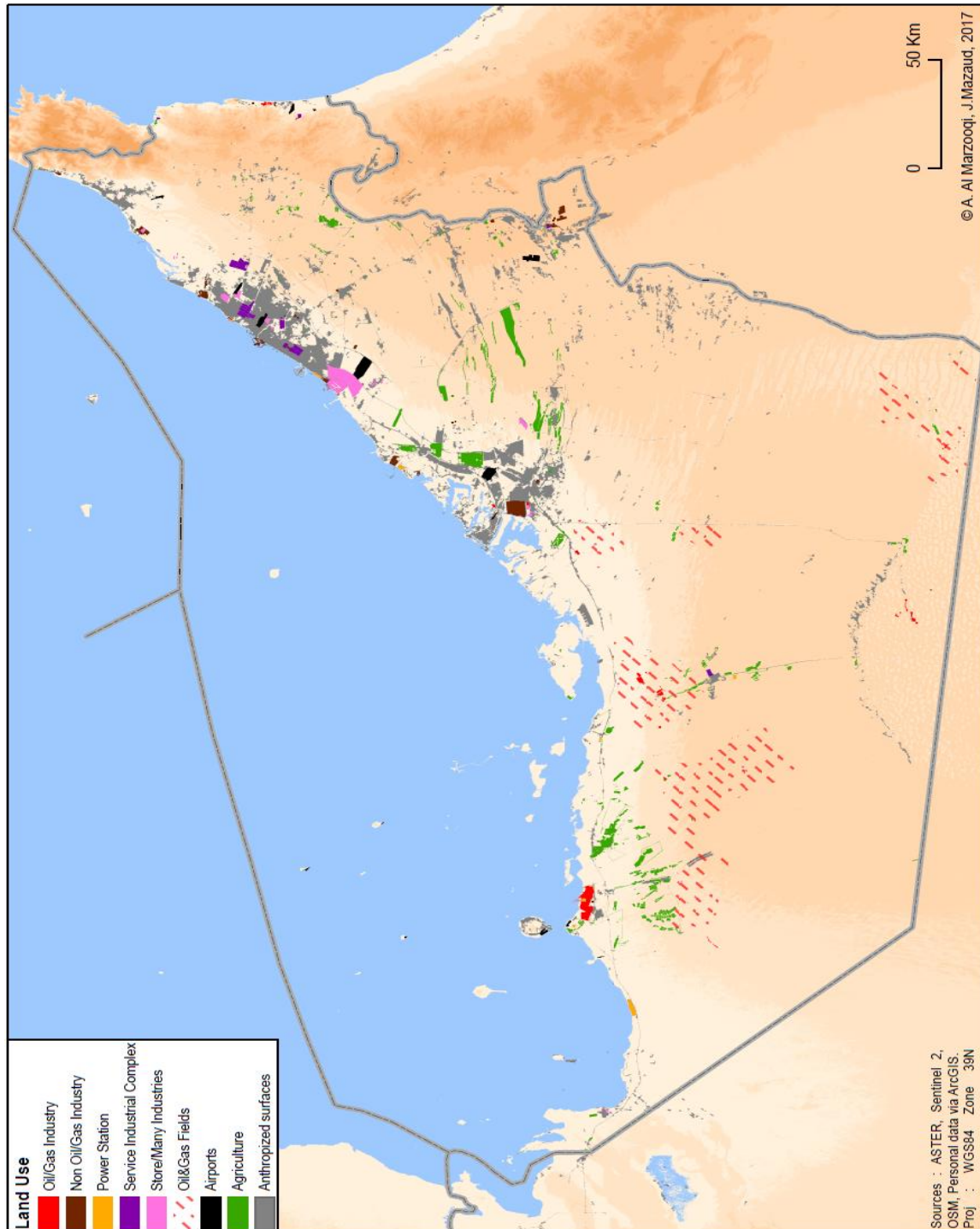
Source: NCEMA, 2007, p. 53

Some social responsibility of minimizing risks associated with natural disasters lies with the public while the rest is with the government. However, if the UAE government heightens the level of public awareness, it is possible to prevent the damages and losses in many natural disasters before they occur. Even when the same occur, good coordination between the Civil Defense Forces, Police, local, regional and international bodies can still give good results in the UAE. The previous section indicates a new human resource potential of using students to offer support to disaster management agencies in distributing food, drinking water, tents and other logistical supports. The UAE government should explore this avenue further by including a disaster prevention and management course in their curriculum²⁷⁵ to increase awareness from early ages.

²⁷⁵ F, Ozmen, The level of preparedness of the schools for disasters from the aspect of the school principals *Disaster Prevention and Management* 15, 2006, 383 - 395.

CHAPTER 7: DETAILED ACCOUNT OF NON-NATURAL DISASTERS AT GCC AND UAE

Figure 37 (A): The Hierarchy of Industries in the UAE for Oil and Non-Oil Sectors



Source: Al Marzooqi and J. Mazaud 2017

7.1 Road Traffic Accidents

In the UAE, the frequency of Road Traffic Accidents (RTAs) was declared a national disaster owing to the higher trends compared to other nations²⁷⁶. The availability of oil resources has attracted very many international expatriates to the nation, most with different driving trainings from their country of origin²⁷⁷. Furthermore, most of these expatriates drive around the UAE roads and this increases the vulnerability for accidents.

The Ministry of Transport in the UAE blames aggressive drivers for the numerous numbers of RTAs, with carelessness being the most notorious behavior at more than 35% of cases. Over speeding was next most notorious cause²⁷⁸. From the turn of the century, the UAE has had a rapid increase of population, most of who drive around. Therefore, the UAE government saw fit to expand the road sizes to improve safety and efficiency of getting around places. However, the people's behavior on the road has been quite the opposite in enhancing safety²⁷⁹. The fact that most expatriates have different international background does not help matters as far as familiarity with regulations and roads is concerned. Therefore, the Ministry of Transport is continually gathering data on the RTAs as part of the risk management process²⁸⁰. The following figure illustrates the statistical data for RTAs in the UAE from 1977 to 2000.

²⁷⁶ A. Bener & D. Crundall, 'Road Traffic Accidents in the United Arab Emirates Compared to Western Countries.' *Advances in Transportation Studies an International Journal Section A6*. 2005, pp. 5-12.

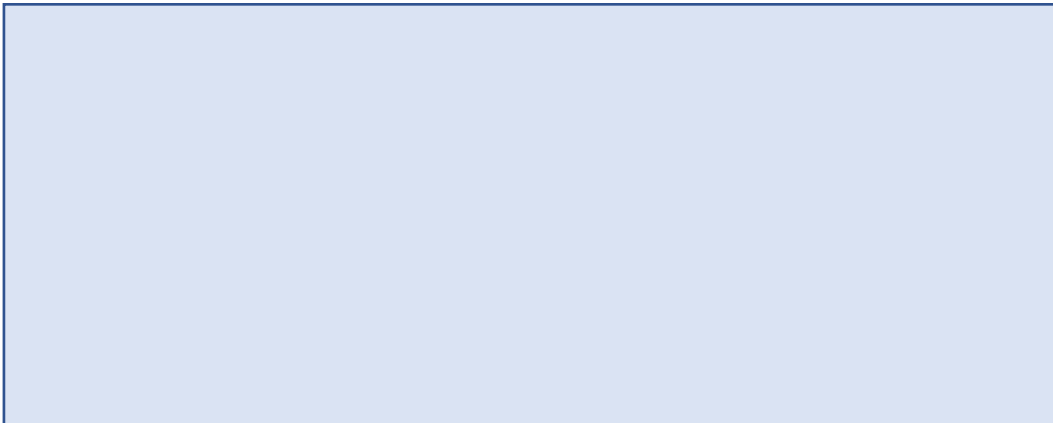
²⁷⁷ A. Bener, E. Breger & Al-Falasi, A. 'Risk-taking behaviour in road traffic accidents.' *Journal of Traffic Medicine*, 23, 1994; pp. 65 – 70.

²⁷⁸ A. Bener, 'Road Traffic Injuries in developing countries: Motor Vehicle Accidents in the United Arab Emirates: Strategies for prevention.' Global Forum for Health Research, the 10/90 Gap in Health Research, Forum 5, Geneva, 9-12 October 2001, pp 221-222.

²⁷⁹ Bener, et al., 1994, p. 66.

²⁸⁰ Bener & Crundall, p.6.

Figure 37 (B): Road Traffic Accidents Events in the UAE from 1977 to 2000



Source: Bener, A. & Crundall, 2005, p.7.

The table below is a comparison of the RTAs for the United Arab Emirates, United Kingdom, United States of America and Qatar. From the table below, it is evident that the RTAs for UAE for every 100,000 vehicles were nearly 6 times for USA and 10 times for UK. Research shows that the deaths and injuries from RTAs in the UAE exceed the rest of the GCC member states²⁸¹. Due to this disastrous trend, the UAE had embarked on a mission of risk management for the RTAs.

²⁸¹ A. Bener, F. M. Abu-Zidan, A. K. Bensiali., A. A. K Al-Mulla, K.S. Jadaan, 'Strategy to improve road safety in developing countries.' *Saudi Medicine Journal*; 2003; 24: 603-608.

Table 16: Statistical Comparison of RTAs for UK, USA, UAE and Qatar

Country and Year	UK 2000	USA 2000	UAE 2000	Qatar 2000
Description				
Motor vehicle deaths	3,409	41,471	673	85
Vehicle travel (million km)	467,700	2,750,000	19,970	7,278
Registered vehicles	28,890,000	217,028,000	575,929	303,245
Passenger cars	23,196,000	205,102,000	537,918	286,883
Registered population	60,000,000	274,634,000	3,108,000	578,470
Death Rates				
Fatality per 100 million vehicle km	0.72	1.51	3.37	1.2
Fatality rate per 100,000 population	5.7	15.1	21.6	14.7
Fatality rate per 100,000 vehicles	11.8	19.1	116.8	28.0
Population per vehicle	2.1	1.3	5.4	1.9
Population per car	2.6	1.3	5.8	2.0

Source: Bener, A. & Crundall, p.8.

Even though the drivers' behavior was attributed for the higher proportion of the RTA, research shows that other factors like age, sex, marital status, education, training, experience, way of life, emotional status, fatigue, reaction time, vision, vigilance and driving speed also play a very critical role in the annual statistics²⁸². The research by Bener & Crundall sought to understand the association between the deaths and other UAE demographic factors such as "Vehicle per person, GNP per capita, Population ration per medical physician, population per hospital bed and Percentage of school age population attending school."²⁸³ Using simple regression method, the researchers established that "vehicle per person; population per hospital bed and percentage of school age population attending school" was the most significant log determinants of RTA deaths in UAE²⁸⁴. The following table illustrates the exact causes of RTAs in the UAE in

²⁸² Bener & Crundall, p.6.

²⁸³ Bener & Crundall, p. 9

²⁸⁴ Bener & Crundall, p. 9-10.

the year 2000²⁸⁵, whereby, carelessness and over speeding combined accounted for 62% of all deaths.

Table 17: UAE's RTAs by Accidents, Casualties and Fatalities

DRIVER'S ERRORS & VIOLATIONS	ACCIDENTS		CASUALITIES		FATALITIES	
	Frequency	%	Frequency	%	Frequency	%
Carelessness	4224	38.0	3703	35.0	240	35.6
Excessive Speed	1456	13.1	2063	19.5	181	26.9
Tail gating	711	6.4	582	5.5	11	1.7
Driving Opposite Direction	545	4.9	614	5.8	17	2.5
Incorrect overtaking	522	4.7	614	5.8	38	5.7
Disregarding traffic red light	467	4.2	307	2.9	15	2.2
Drug and Alcohol	445	4.0	317	3.0	11	1.7
Disallowing priority pedestrian	389	3.5	497	4.7	34	5.0
Incorrect Reversing	233	2.1	254	2.4	15	2.3
Vehicle condition	211	1.9	307	2.9	34	5.1
Animals	156	1.4	42	0.4	4	0.6
Incorrect cornering	145	1.3	159	1.5	3	0.5
Using incorrect lane	67	0.6	95	0.9	13	2.0
Others	1545	13.9	1026	9.7	55	8.2
TOTAL	11116	100	10581	100	673	100

Source: Bener & Crundall, p.8.

In analyzing the RTA disaster situation of the UAE, it is important to note that since the country became independent, many people have been migrating from all over the world to grab the job opportunities²⁸⁶. Comparing GCC nations like Qatar with nearly equal number of vehicles, the RTA deaths in UAE stand out higher and further more to the UK and USA. The RTA deaths in the UAE are unique when compared with other nations because of their causes. This implies that the UAE must review their policies to reduce these soaring fatalities. The simpler thing that UAE can adopt is the other nation's model or policies of reducing RTA fatalities. Moreover, if the UAE is to carry out a risk

²⁸⁵ Bener & Crundall, p.8,

²⁸⁶ Bener, et al., 2003, p.604.

assessment and RTA safety campaign to the public, the media must be sensitive to the multicultural background of the population to assure effectiveness of communication²⁸⁷.

Since the RTA deaths for every 10,000 automobiles in the UAE at 13.3 for the year 2000 was double that of Kuwait and Saudi Arabia, the assumption is that being GCC members the demographic features are somewhat similar. Therefore, risk management policy replication could have positive impact. However, it appears that in the UAE, the population lifestyle is more liberal including their cultural orientations. Research shows that issues like driver behavior on the UAE roads leading to the high fatalities is associated with non-compliance with road safety rules. This study recommended that RTAs risk management in the UAE should include improving the medical services and public awareness on safe driving as a strategy of minimizing fatalities and injuries in the current decade²⁸⁸.

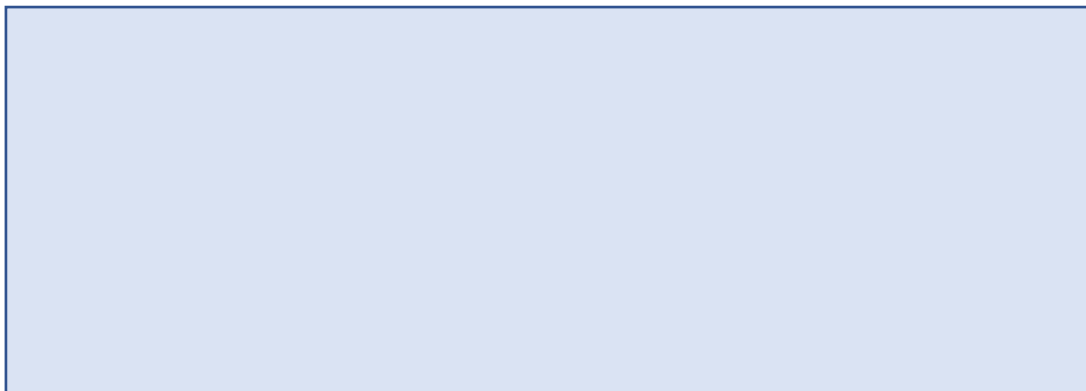
On March 11th, 2008, there was a pile up accident involving nearly 200 cars along the Dubai-Abu Dhabi highway. At least 25 cars were burnt up while others were damaged from primary collision and secondary panic in an attempt to evacuate. The Gulf News indicated that six people died and another 40 seriously injured. This highway disaster was regarded as the worst according to the data of accidents in the UAE. In terms of response to the highway disaster, the Dubai Police were able to fly the injured persons to the nearby hospitals using several helicopters as the highway patrol vehicles tried to clear the way. Even though the police exonerate the cause of accident to the prevailing foggy conditions, it was clear that most motorists involved do not keep the stipulated distance between vehicles while driving on the highway²⁸⁹. The following image illustrates the extent of the highway disaster.

²⁸⁷ Bener & Crundall, p. 10.

²⁸⁸ Ibid.

²⁸⁹ Al Arabiya News, *200 cars involved in worst UAE crash ever*. Al Arabiya.net, 2008, Retrieved January 26, 2015, <http://www.alarabiya.net/articles/2008/03/11/46779.html>

Figure 38: Section of the 200 Cars Crash in UAE



Source: Al Arabiya News, 2008.

7.2 Marine Pollution

For years, the Arabian Gulf has suffered intense marine pollution from different man-made sources. These include heavy metal pollution and other modes of contaminations that alter the ecosystem balance and actually pose risk to human health. Most of the heavy metal pollutions come to the sea via disposal of sewage waste, industry dumping and oil spillages²⁹⁰. Studies show that heavy metal pose anthropogenic hazards to man and other marine organisms since they poison their normal biological functions²⁹¹.

Heavy metal disposal in the marine environment pose risks to human health especially those who feed on sea foods or live and interact with the sea environment. The heavy metals can poison humans, fish and other living organisms when their compounds accumulate in their bodies over time. Many people living in the GCC rely on fish in their main diets²⁹². Therefore, it is obvious that people who place fish high up their food chains are likely to accumulate heavy metals in their bodies over a period of consumption if they

²⁹⁰ H. A. Naser, 'Assessment and management of heavy metal pollution in the marine environment of the Arabian Gulf: A review.' *Marine Pollution Bulletin*, 72, 2013; pp. 6-13.

²⁹¹ Y. Ruilian, Y. Xing, Z. Yuanhui, H. Gongren & T. Xianglin, 'Heavy metal pollution in intertidal sediments from Quanzhou Bay,' China. *Journal of Environmental Sciences*, 20, 2008; pp. 664–669.

²⁹² D, DeForest, K, Brix, W, Adams, 'Assessing metal bioaccumulation in aquatic environments: The inverse relationship between bioaccumulation factors, trophic transfer factors and exposure concentration.' *Aquatic Toxicology*. 84, 2007; 236–246.

are from the Arabian Gulf region²⁹³. This finding justified why scientist often track the extent of pollution by the heavy metals to advice the concerned consumers²⁹⁴.

A study to determine the presence of heavy metals in *Lethrinus Lentjan* fish species gathered from the West shorelines of UAE established that were within permissible limits defined by the World Health Organization (WHO) ²⁹⁵. However, a later study to determine the level of heavy metals on two fish called the orange spotted grouper and the spangled emperor with high market values in the UAE had contrary findings. The liver of the Spangled emperor species had (7.19 and 9.94 lg g⁻¹) of Cadmium for samples gathered around the UAE shorelines. Moreover, the liver of spotted orange grouper had (109 and 195 lg g⁻¹) of Cadmium for fish samples gathered in the shorelines of Oman. The researchers attributed these excessive cadmium levels to nutrient enrichment from the multiple pollution activities in the area²⁹⁶.

Other researchers²⁹⁷ have established that heavy metal pollution in marine can also be carcinogenic and the world is currently grappling with the high cost of treating cancer for millions of people. For the most sensitive organisms, marine pollution by heavy metals could cause their extinction and eventually affect the biodiversity imbalance of their food chain²⁹⁸. Some researchers have determined that heavy metals can anthropogenically contaminate marine ecosystem by the operations like desalination industry, which is big deal in UAE, ship services, waste disposal and domestic dumping²⁹⁹.

Land reclamation and dredging around the shorelines of the Arabian Gulf has been cited as one of the most active contributors to marine pollution. These activities go on to avail more land for social and industrial activities. As the population of the Arabian Gulf nation increases, there is demand for more houses and associated facilities. Hence, land

²⁹³ M. Al-Yoursuf, M. El-Shahawi, S. Al-Ghais, 'Trace metals in liver, skin and muscle of *Lethrinus lantjan* fish species in relation to body length and sex.' *Science Total Environment*, 256, 2000; pp. 87–94.

²⁹⁴ Q. Zhou, J. Zhang, J. Fu, J. Shi, G. Jiang, 'Biomonitoring: an appealing tool for assessment of metal pollution in the aquatic ecosystem.' *Annals of Chemical Action*, 606, 2008; pp.135–150.

²⁹⁵ Al-Yoursuf, et al., 2000, p. 87-94.

²⁹⁶ S. De Mora, S. Fowler, E. Wyse, S. Azemard, 'Distribution of heavy metals in Marine bivalves, fish and coastal sediments in the Gulf and Gulf of Oman.' *Marine Pollution Bulletin*, 49, 2004; pp. 410–424.

²⁹⁷ F. Fu & Q. Wang, 'Removal of heavy metal ions from wastewaters: a review.' *Journal of Environmental Management*, 92, 2011; 407–418.

²⁹⁸ T. Hosono, C. Su, F. Siringan & A. Amano S. Onodera, 'Effects of environmental regulation on heavy metal pollution decline in core sediments from Manila Bay.' *Marine Pollution Bulletin*. 60, 2010; 780–785.

²⁹⁹ Fu & Wang, p. 410

reclamation is a very active undertaking³⁰⁰. Similarly, the preference of economic activities around the Arabian Gulf is leading many developers to dredge the shorelines in the Arabian Gulf and this too comes with numerous risks. The dredging process tends to destabilize the marine ecosystem and some organisms either die or have to migrate to safe locations with less light and saline concentration³⁰¹.

A recent study stated that over 40% of the Arabian Gulf shore lines were under some sort of development from the natural shape and form³⁰². Consequently, the Arabian Gulf shorelines are undergoing biological agitations, physical transformation and chemical pollution. Ultimately, the Arabian Gulf shoreline becomes weak from the activities of the heavy machinery and the organism die due to reduced oxygen conditions and this is extremely appalling to the environmental conservation goals³⁰³. Moreover, the physical alterations and chemical pollutions of the Arabian Gulf environment is leading to extinction of most vulnerable organisms, depletion of natural resources, abundance of toxicities and migration of marine organisms³⁰⁴. The dredging activity is particularly blamed for stirring heavy metal sediments in the Arabian Gulf as the activist attempt to reclaim more land. Collectively, all the activities around dredging and excavation along the Arabian Gulf disorientate the food chain and breeding spots for fish, other edible marine organisms, and the risk could pass to humans³⁰⁵.

A study sought to establish the levels of Total –Mercury (T-Hg) and Methyl-Mercury (Me-Hg) disposed in edible fish muscles, sampled gathered in the Iranian coastline. The results of the study indicated that 3% of the sample had Hg $>0.5 \text{ lg g}^{-1}$, that is above the WHO limit. Another 9% of the fish samples had Hg of 0.5 to 0.5-lg g^{-1} concentration,

³⁰⁰ H. Naser, 'Effects of reclamation on macrobenthic assemblages in the coastline of the Arabian Gulf: A microcosm experimental approach.' *Marine Pollution Bulletin*, 62, 2011; 520–524.

³⁰¹ H. Naser, J. Bythell & J. Thomason, 'Ecological assessment: an initial evaluation of ecological input in environmental impact assessment reports in Bahrain.' *Impact Assessment and Project Appraisal*, 26 (3), 2008; pp 201–208.

³⁰² W. Hamza & M. Munawar, 'Protecting and managing the Arabian Gulf: past, present and future.' *Aquatic Ecosystem Health Management*. 12, 2009; 429–439.

³⁰³ S. Allan, C. Ramirez, J. Vasquez, 'Effects of dredging on subtidal macrobenthic community structure in Mejillones Bay, Chile.' *International Journal of Environmental Health*, 2, 2008; 64–81.

³⁰⁴ S. Smith & M. Rule, 'The effects of dredge-spoil dumping on a shallow water soft sediment community in the Solitary Island Marine Park, NSW, Australia.' *Marine Pollution Bulletin*, 42, 2001; 1040–1048.

³⁰⁵ R. Guerra, A. Pasteris, M. Ponti, 'Impacts of maintenance channel dredging in a northern Adriatic coastal lagoon. I: Effects on sediment properties, contamination and toxicity.' *Estuary Coastline Shelf Science*, 85, 2009; 134–142.

still above acceptable limits³⁰⁶. These high levels attributed to the dredging activities in the Iranian coastlines.

Sewage disposal into the Arabian Gulf is yet another risky concern for marine pollution in the GCC region. This trend is appalling even though there are advanced sewage treatment systems between the GCC and UAE in particular. Every day, volumes of sewage effluents are disposed to the Arabian Gulf shorelines³⁰⁷ the immediate consequence being floating solids and concentrated ammonia and phosphate compounds³⁰⁸. In most cases, the marine pollution via sewage effluents³⁰⁹ come with some heavy metals which as stated earlier, cause ecological imbalance of decimation of the sea organisms.

A study to determine level of heavy metals from suspected waste disposal into sea around Saudi Arabia sampled four fish types; Emperors, Greasy-grouper, Rabbit fish and Double bar-bream. These fish species were collected adjacent to waste disposal plants of municipal, agricultural and petrochemical activities. The result show that Cadmium (Cd), Lead (Pb) and Arsenic (As) were beyond the limits of industrial waste stipulated for each sector activity. Nevertheless, these limits were within the permissible levels for one time fish consumption according to the Saudi laws and EU standards. Therefore, continuous consumption of such fish is dangerous as can cause bioaccumulation in various human organs to toxic and fatal levels over the years³¹⁰.

Industrial effluents are another source of pollution for the Arabian Gulf shorelines. Over the years, heightened activities from industries and machinery have led to depositing of oil and associated waste products. Additionally, the petrochemical refinery activities near the Arabian Gulf shorelines often discharge wastes having heavy metals to

³⁰⁶ H. Agah, M. Leermakers, Y. Gao, S. Fatemi, M. Katal, W. Baeyens, M. Elskens, 'Mercury accumulation in fish species from the Arabian Gulf and in human hair from fishermen.' *Environmental Monitoring and Assessment*, 169, 2010; pp. 203–216.

³⁰⁷ C. Sheppard, M. Al-Husiani, F. Al-Jamali, F. Al-Yamani, R. Baldwin, J. Bishop, et al., 'The Gulf: a Young sea in decline.' *Marine Pollution Bulletin*, 60, 2010; pp 3–38.

³⁰⁸ H. Naser, 'Human Impacts on Marine Biodiversity: Macrobenthos in Bahrain, Arabian Gulf.' In: Lopez-Pujol, J. (Ed.), *The Importance of Biological Interactions in the Study of Biodiversity*. InTech Publishing, Croatia, 2011a. pp. 109–126.

³⁰⁹ K. Singh, D. Mohan, S. Sinha & R. Dalwani, 'Impact assessment of treated/ untreated wastewater toxicants discharged by sewage treatment plants on health, agricultural, and environmental quality in wastewater disposal area.' *Chemosphere*, 55, 2004; pp. 227–255.

³¹⁰ I. Al-Saleh, N. Shinwari, 'Preliminary report on the levels of elements in four fish species from the Arabian Gulf of Saudi Arabia.' *Chemosphere*, 48, 2002; pp. 749–755.

the sea³¹¹. Some of the chemical byproducts from the oil refinery plants include “chromium, iron, nickel, copper, molybdenum, selenium, vanadium and zinc”³¹². Due to the availability of oil reserves in the GCC nations, it is therefore understandable that the heavy metal contamination³¹³ is rampant as machineries emit greases, phenols, sulphides, ammonia among other pollutants. A study³¹⁴ to test the level of Total Mercury (T-Hg) and Methyl-Mercury (Me-Hg) disposed on 7 fishy types gathered around Kuwait established that 20.6% from the random sample of 330 pieces had 0.5 lg^{-1} T-Hg and 0.3 lg^{-1} Me-Hg way above the WHO standard limits. The heavy metal pollutions attributed to the industrial activity around the Arabian Gulf.

Due to shortage of fresh water from boreholes and inland dams or rivers, most of the domestic and industrial water sources are in the Arabian Gulf nations such as the UAE is from desalination process. The rapid increase of population among the affected GCC also puts more pressure for the desalinized water sources to supplement the few fresh water sources³¹⁵. Most of the Arabian Gulf nations do not receive rainfall over long time and some have vast areas of their lands as deserts. The desalination plants are strategically placed along the shorelines for ease of accessing raw water. However, the same proximity to the ocean also leads to pollution from the engineering processes³¹⁶. Studies project that the capacity of water desalination at the Arabian Gulf is equivalent to 60% of the global processes³¹⁷. However, the waste products from these processes laden with heavy metals are the point of concerns because of the magnitude of daily pollution³¹⁸. A

³¹¹ P. Sale, D. Feary, J. Burt, A. Bauman, G. Cavalcante, K. Drouillard, B. Kjerfve, E. Marquis, C. Trick, P. Usseglio, H. Van Lavieren, ‘The growing need for sustainable ecological management of marine communities of the Arabian Gulf.’ *Ambio*, 40, 2010; pp.4–17.

³¹² H. Wake, ‘Oil refineries: a review of their ecological impacts on the aquatic environment.’ *Estuary Coastline Shelf Science*, 62, 2005; pp. 131–140.

³¹³ De Mora, S., Tolosa, I., Fowler, S., Villeneuve, J., Cassi, R., Cattini, C., ‘Distribution of petroleum hydrocarbons and organo-chlorinated contaminants in marine biota and coastal sediments from the ROPME Sea Area during 2005.’ *Marine Pollution Bulletin*, 60, 2010; pp. 2323–2349.

³¹⁴ N. Al-Majed, & M. Preston, ‘An assessment of the total and methyl mercury content of zooplankton and fish species tissue collected from Kuwait territorial waters.’ *Marine Pollution Bull.* 40, 2000; pp. 298–307.

³¹⁵ R. Smith, A. Purnama, H. Al-Barwani, ‘Sensitivity of hypersaline Arabian Gulf to Seawater desalination plants.’ *Application Mathematical Model*. 31, 2007; pp. 2347–2354.

³¹⁶ A. Hashim & M. Hajjaj ‘Impact of desalination plants fluid effluents on integrity of seawater, with the Arabian Gulf in perspective.’ *Desalination*, 182, 2005; pp. 373–393.

³¹⁷ S. Lattemann & T. Hopner, ‘Environmental impact and impact assessment of seawater desalination.’ *Desalination*, 220, 2008; pp. 1–15.

³¹⁸ H. Naser, ‘Testing taxonomic resolution levels for detecting environmental impacts using macrobenthic assemblages in tropical waters.’ *Environmental Monitoring Assessment*, 170, 2010; pp. 435–444.

study on five major desalination plants' Al- Shuwayhat, Al-Marfa, Umm AlNar and Taweelah, Jebel Ali and Al-Layah seeking to model and simulate their oil spillage trends established that huge volumes leak every year³¹⁹.

The fact that the Arabian Gulf is endowed with oil deposits is not in dispute turning to the current century. Nevertheless, the collateral pollution that comes with this energy enrichment, exploration and refinery operations is a matter that perturbs most environmental conservationists. The concerns from environmental conservation champions in every regular GCC meeting are a clear sign that something must be done to curtail the pollution trends³²⁰. Even the oil transporters have fair share of blame for the spillages and pollutions that occur around the Arabian Gulf every year³²¹. Some of the most notorious sources of spillages include "offshore oil wells, underwater pipelines, oil tanker incidents, oil terminals, loading and handling operations, weathered oil and tar balls, illegal dumping of ballast water, and military activities."³²²

Among the most memorable oil spillage disasters around the Arabian Gulf was during the 1991 Gulf War. Analysts project that at least 10.8 million barrels of oil spillage was experienced. Hence, the level of heavy metal pollution in the Arabian Gulf increased tremendously³²³. The following table illustrates the reasons for oil spills during the 1991 Gulf war.

³¹⁹ W. Elshorbagy & A-B. Elhakeem, 'Risk Assessment Map of Oil Spill for major Desalination Plants in the United Arab Emirates.' *Desalination*, 228, 2008; pp.200-216

³²⁰ P. Literathy, N, Khan, O, Linden, 'Oil and Petroleum Industry. 'In: Khan, N., Munawar, M., Price, A. (Eds.), *The Gulf ecosystem: Health and Sustainability*. Backhuys Publishers, Leiden, 2002; pp. 127–156.

³²¹ MEMAC (Marine Emergency Mutual Aid Centre). *Oil Spill Incidents in ROPME Sea Area* (1965-2002). MEMAC, Bahrain, 2003.

³²² Sale, et al., p. 10

³²³ M. Massoud, F. Al-Abdali, A. Al-Ghadban, 'The status of oil pollution in the Arabian Gulf by the end of 1993.' *Environment International*. 24, 1998; pp. 11–22.

Table 18: Oil Spills during Gulf War – Cause Wise

Cause	Volume (million US gal.)
Grounding	0.02
Collision	32.65
Explosion/fire	13.54
Sinking	1.48
Military action	439.71
Internal discharge	0.44
Leakage	0.03
Unspecified	28.87
Unknown (not reported)	46.62

Source: Elshorbagy & A-B. Elhakeem, p. 201.

There were at least 22 major oil leak accidents during the Gulf war with a separate study indicating that 371 million US Gallons wasted to the water environment at the UAE. Since most of the people in the UAE depend on the desalinized water for their domestic and industrial sources, it is imperative for the government to ensure the environment around the plants are clear of oil pollution. However, in 1994 the Seki Vessel incidence caused a scare for a major disaster when over 16,000 tons of crude oil was spilled in the adjacent shorelines. The situation was salvaged before the oil reached the desalination plant. The Seki incidence was due to the vessel colliding with another. In 1998 another ship Pontoon300 also spilled nearly 5,500 tons of fuel into the territorial waters of the UAE. The Pontoon300 occurred due to sinking of the vessel and over 500,000 people were affected by the situation because their source of water for desalination was contaminated. Therefore, the adjacent desalination plants had reduced water intake and the efficiency was greatly reduced. Even other organisms were affected by this second oil spillage because the light penetration and oxygen circulation was curtailed³²⁴. The following table illustrates other notable vessel oil spillages since 1974 around the Gulf Area.

³²⁴ Elshorbagy & A-B. Elhakeem, p. 201.

Table 19: Major Tanker Spills of Over 5,000 t in the Gulf Region Since 1974

Vessel Name	Quantity spilled (t)	Type	Country	Year	Cause
Nova	70,000	Crude	Iran	1985	Collision
Assimi	52,500	Crude	Oman	1983	Fire/explosion
Pericles GC	46,000	Crude	Qatar	1983	Fire/explosion
Seki	16,000	Crude	UAE	1994	Collision
Pontoon300	5,500	Fuel (cargo)	UAE	1998	Sinking

Source: Elshorbagy & A-B. Elhakeem, p. 202.

7.3 Air Pollution

Significant air pollution around the Arab regions like UAE happen due to human activities and contributes to the current environmental problems such as greenhouse emissions and subsequently global warming. As industrial investors embrace oil run machineries in the UAE, the level of CO₂, Nitrous and Sulfur gas emissions have been astronomical. The effect of global warming is evident from the changing weather patterns as documented in numerous occasions. The seriousness of the air pollution disaster has lead nations to embrace local, regional and international bodies that stand out and outline policies and frameworks for reducing the risks³²⁵.

Research shows that 90% of CO and CO₂ in UAE among other Arab nations come from the transport sectors. Two decades ago, the entire Arab nations were emitting 16 million tons annually of Carbon Monoxide (CO). Moreover, studies show that automobile in the Arab region emitted 1.1 million tons annually of Nitrogen Oxide (NO). It is the combination of NO and Sulfur Oxide (SO) that mixed with water yields acid rain.

³²⁵ M. El-Raey, *Air Quality and Atmospheric Pollution in the Arab Region*. Joint Report for the Economic and Social Commission for Western Asian and the League of Arab States- Joint Technical Secretariat of the Council of Arab Ministers Responsible for the Environment. 2004, Retrieved http://www.un.org/esa/sustdev/csd/csd14/escwaRIM_bp1.pdf

Moreover, NO is a component of photochemical smog which has historically blurred vision in many Arab nations and the rest of the world³²⁶.

Two decades ago, the Arab nations were emitting 3 million tons of Hydrocarbons (HC) from automotive drive around. HC also has active role in photochemical oxidation. Moreover, the Lead (Pb) which is a component for petrol was responsible for over 50% of major pollutant in all places. However, current petrol brands have unleaded petrol to address this problem. The SO₂ is an active component of diesel and other than its emission in the vehicles; the construction industries like cement factories and sites around the Arab world have significant use of this fuel. Research shows that the Arabian Gulf nations account for half CO₂ greenhouse emissions and the prospects for reduction are challenging because of the increasing demand for energy sources³²⁷.

7.4 Airline Disaster on Land

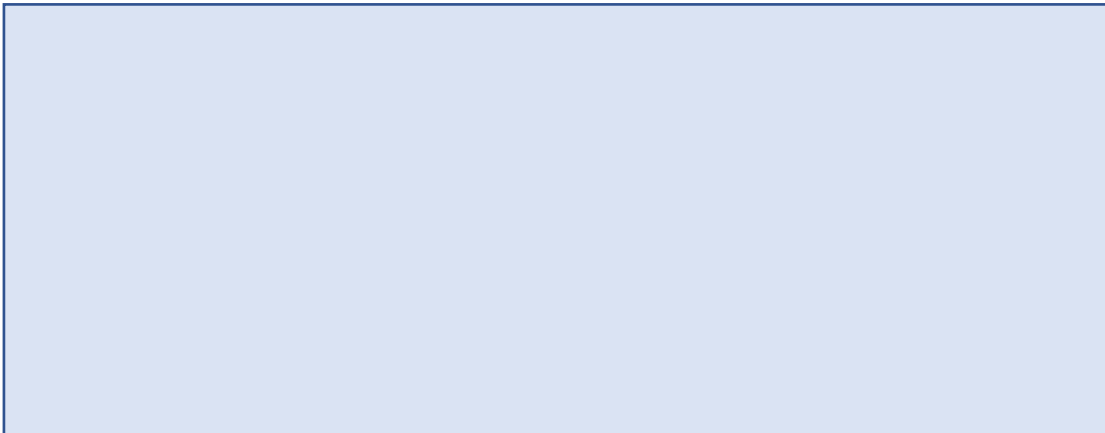
On 10th February 2004, an airplane Fokker F27 Mk.050 belonging to Kish Airlines but registered in Iran crashed as it approached landing at the Sharjah International Airport. On the fateful day, the Dutch manufactured aircraft, within clear visibility of runway 12 at Sharjah Airport started to descend. However, this operation was unsuccessful as it crashed on the sand sections next to the runway, at an angle that caused a serious accident³²⁸. As the plane was descending to land below the 1000ft altitude, the speed reduces, and then there was loss of radar communication, possible due to an abrupt technical error because the detailed information from the investigators show the plane was in good service mode and the pilots were well in health and not intoxicated³²⁹. The following image illustrates the investigation details of the scene.

³²⁶ El-Raey, p. 9.

³²⁷ El-Raey, p. 9.

³²⁸ UAE General Civil Aviation Authority, *Aircraft Accident 01/04: Final Report on the Accident Involving Kish Airlines Fokker F27 MK.050 Iranian Registered As EP-LCA on Approach to Sharja International Airport, United Arab Emirates on February 10, 2004*. April 21, 2005, Retrieved http://cfapp.icao.int/fsix/sr/reports/04000240_final_report.pdf

³²⁹ UAE General Civil Aviation Authority, p. 46.

Figure 39: Fokker F27 Landing Accident

Source: UAE General Civil Aviation Authority, p. 23.

The following table shows the descending process:

Table 20: Fokker F27 descent to landing and radar communication

Time (UTC)	Lat/Long	Bearing/distance from SHJ VOR	Mode C (alt)	Groundspeed (kt)	Radar track (°M)
07h 38 min 15s	N 25° 21' 24.9" S 055° 28' 09.5"	298/3.23 nm	900 ft.	187	118
07h 38 min 20s	N 25° 21' 11.7" S 055° 28' 13.3"	295/3.06 nm	NMC	177	No record
07h 38 min 25s	N 25° 21' 19.2" S 055° 28' 32.6"	300/2.87 nm	100 ft.	168	No record

Source: UAE General Civil Aviation Authority, p. 16.

Information from the aircraft voice control indicated that, as the plane was about to land the pilot instructed the first officer to take control. The pilot gave no reason for this action. The conversation indicated that the first officer was hesitant, giving reason that he was not confident or experienced. The captain persisted, urging the first officer on. The investigators considered this as the possible human error that escalated to the accident. The first officer appeared to have complied and engaged the landing gear while the aircraft was still way out of position. Shortly after this gear was engaged, the aircraft lost speed. Normally, this process is irreversible for the Fokker plane designs. On realizing the problem, the pilot then tried to take control of the plane with not much success. The

investigators recommended that the future designs of the Fokker F27 series should have a crash image recorder as available on all other bigger commercial planes to ease such investigations in future³³⁰. Due to this accident, there were 43 deaths and 3 serious injuries as shown in the following table.

Table 21: Breakdown of Deaths and Fatalities after the Fokker F27 Accident

<i>Injuries</i>	Nationality	Crew	Passengers	Total in Aircraft	Others
<i>Fatal</i>	Iranian	6	11	17	0
	Indian	0	13	13	0
	Egyptian	0	3	3	0
	Algerian	0	2	2	0
	Filipino	0	1	1	0
	Bangladeshi	0	1	1	0
	Cameroonian	0	1	1	0
	Emirati,UAE	0	1	1	0
	Nepalese	0	1	1	0
	Nigerian	0	1	1	0
	Sudanese	0	1	1	0
	Syrian	0	1	1	0
	Total	6	37	43	0
<i>Serious</i>	Iranian	0	1	1	0
	Egyptian	0	1	1	0
	Filipino	0	1	1	0
	Total	0	3	3	0
<i>Minor</i>		0	0	0	0
<i>None</i>		0	0	0	0
<i>Total</i>		6	40	46	0

Source: UAE General Civil Aviation Authority, p. 11.

7.5 Radioactive Accidents and Emergency Management

The FANR is further responsible for managing radioactive material that is in transit to or from the designated plants. The Federal Law by Decree No.6 of 2009 espoused

³³⁰ UAE General Civil Aviation Authority, p. 46-47.

alternative uses of nuclear energy other than war and clarified the following responsibilities to be undertaken during emergency: Article 49³³¹ envisages that, “The competent authorities and licensees shall establish measures for Emergency Preparedness and Emergency Response. Emergency Planning measures shall be established: for protection of the population (off-site Emergency Plan) and for each Nuclear Facility and the facility that contains sources of nuclear radiations (on-site Emergency Plan)”.

Article 7³³² envisages that, “The License issued by FANR shall specify: the Emergency Preparedness... FANR shall co-operate with the relevant government entities, advise them, and provide information on matters related to nuclear security radiation protection and security concerning following areas: ... Emergency planning and Emergency Preparedness ...”

Normally, accidents and disasters involving radioactive material are handled at local and federal level. The following is the organizational structure for emergency response during radioactive material leakages.

Figure 40: UAE National Emergency for Radioactive Accident Management



Source: Nuaimi, 2013, p. 7.

The UAE has a case study of radioactive accident that occurred in 25th October 2011. A licensed firm misplaced an iridium projector for administering radiography. This

³³¹ Nuaimi, A. A. *Management of emergencies, safety and security events*, Federal Authority for Nuclear Regulation. United Arab Emirates. 2013, p.4 Retrieved <http://gnssn.iaea.org/CSN/Abu%20Dhabi%20Conference/Shared%20Documents/Session%207%20presentations/124%20Al%20Nuaimi.pdf>

³³² Ibid.

equipment had radioactivity of 2.85TBq that falls under Category 2 under the IAEA. On the fateful day, the company accomplished tests for radioactive materials around Mussafah region. After work, the equipment carried in a company vehicle back to the office stores. Nevertheless, the equipment went missing during routine checks the following morning 26th October. Consequently, the firm reported the loss to the police. The equipment was later located by a member of the public who cited it on 6th November 2011, nearly 30 km from Abu Dhabi, Mussafah³³³.

As soon as the loss of equipment was reported to police, they too notified the FANR via the provided emergency contacts. Within 60 minutes, the FANR and the Abu Dhabi Police commenced a collective search of the radioactive equipment. Simultaneously, NCEMA and Health Authority of Abu Dhabi (HAAD) were activated to action. There was a mass media alert to relay the press release on the incidence which also featured in the FANR Website. When the police got information of the location of the radioactive equipment, the FANR was also alerted and they inspected to ensure it intact. Next, the FANR alerted the IAEA on the loss and finding of the radioactive equipment³³⁴.

7.6 Why non-natural disasters become more important Issue in this Region of World?

The occurrence of non-natural disasters in the UAE is becoming a regular event over the years; hence, there is need for a more strategic approach starting from risk analysis to disaster prevention. The outcomes of non-natural disaster including deaths and destruction of property have proved to be equally of concern just like the natural disasters. However, the events of natural disaster have some fair room of human action to prevent the effects as compared to the natural disasters. The effects of non-natural disasters have had negative effects on the UAEs social, economic, financial and political prosperity. Nevertheless, the UAE has been establishing various policies that can reduce or reverse the negative effects associated with man-made disasters³³⁵.

³³³ Nuaimi, p. 10.

³³⁴ Nuaimi, p 12.

³³⁵ Al Khaili, K., Pathirage, C. & Amaratunga, D. *Building Disaster Resilience within the Emirati Energy Sector through a Comprehensive Strategic Mitigation Plan*. School of the Built Environment, University of Salford, UK. 2013, Retrieved <http://www.buildresilience.org/2013/proceedings/files/papers/438.pdf>

So far, most of man-made disasters that have befallen the UAE appear complicated at face value until when an investigator or researchers report is published to explain the root causes. The UAE seems to recognize that mitigation for man-made disasters, and strategic interventions with reduced response time after initial reports are some of the steps that can reduce deaths or damage to property. The UAE seems to have appreciated the fact that working towards zero man-made disaster is an uphill task. Therefore, latest campaign strategies involve the concept of ‘disaster resilience and resilient communities.’³³⁶

Non-natural disaster has become important to the UAE because most people and organizations are finally beginning to come to terms with disaster theory. Essentially, anybody is vulnerable to man-made disaster whether by their own making or other people causing events³³⁷. A decade ago, half of the global population was vulnerable to some man-made disaster of sorts.³³⁸ The situation in the UAE is not any different as the population is trying to industrialize they expose to potential hazards. Similarly, as the cost of accessing medical care increases, there are likely to be more deaths for people who cannot afford. This is alarming for the UAE to take a more preventative approach to the issue of man-made disasters³³⁹.

One approach for the UAE to establish a disaster resilient nation is to take lessons from the past and find ways of avoiding similar events in future. The disaster cycle is a strategy that the UAE can use as a learning process organizes in a cyclical manner. The UAE can adopt the disaster cycle stages to understand available information and data from any man-made event. The UAE can benefit from a disaster cycle by specifying the major issues of a disaster and assigning the mitigation stages. The UAE can adopt the disaster cycle to compare past man-made events and establish trends that require additional emergency or mitigation steps³⁴⁰.

³³⁶ Al Khaili, et al., p. 2.

³³⁷ K. Smith & D. Petley, *Environmental hazards: assessing risk and reducing disaster*, Taylor & Francis, 2009.

³³⁸ M. Dilley, R. Chen, U. Deichmann, A. Lernerlam & M. Arnold, M. *Natural Disaster Hotspots: A Global Risk Analysis*. World Bank Publications, 2005.

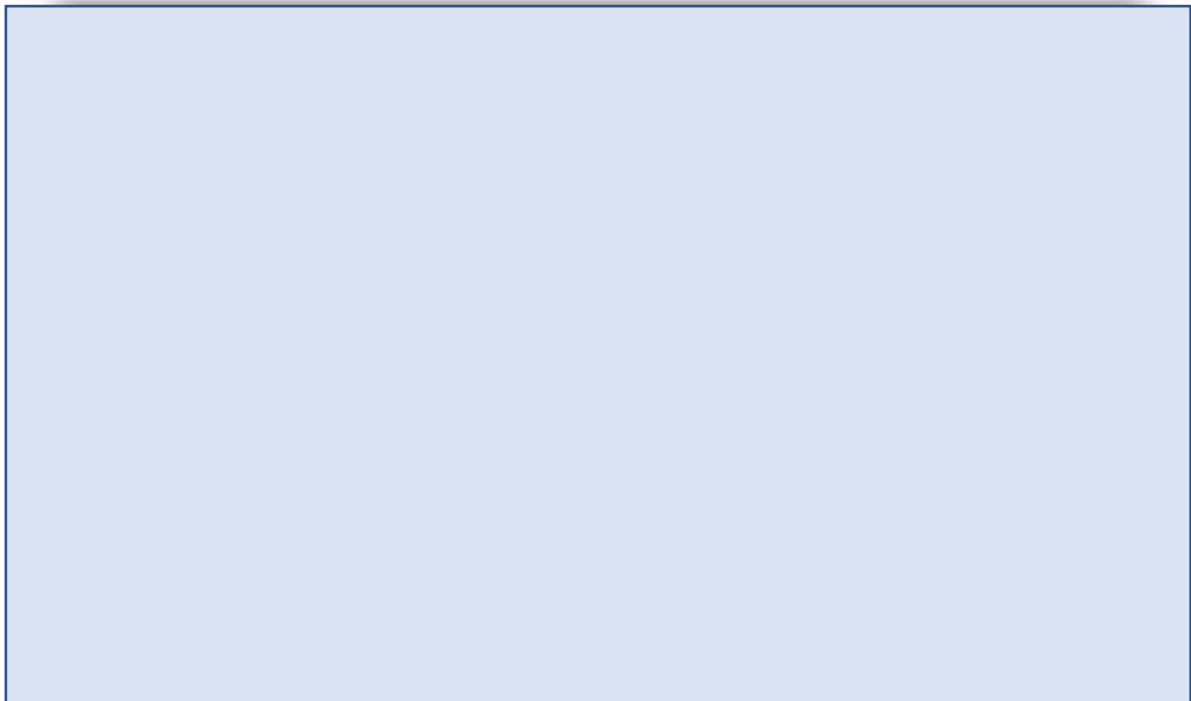
³³⁹ S. Miththapala, *Integrating environmental safeguards into Disaster Management: a field manual* IUCN. 2008.

³⁴⁰ Al Khaili, et al., p. 2

The aim of the UAE is not to perpetuate but to break the disaster life cycle³⁴¹, even though this is a daunting task because man-made disasters are scattered in form and time of occurrence. Therefore, the UAE whenever any man-made disaster occurs, the UAE has been looking at the pre-disaster phase. The pre-disaster phase is “the extensive data collection, maintaining directories of resource, development of action plans, capacity building, training and community awareness activities”³⁴² that is necessary to avert the disaster or intercede. The UAE is handling man-made disaster preparedness to safeguard the population’s interest whether social, economic, cultural or political³⁴³. The outcome of the UAE strategic mapping of man-made disasters is an indication of the countries resilience. This implies that all possible causes of the man-made disaster in under investigation are mapped to know the amount of resources that is necessary to prevent or mitigate the situation³⁴⁴. The following figure illustrates the disaster cycle as applicable in the UAE situation.

Figure 41: Man-made Disaster Cycle Applicable In the UAE

Source: NCEMA, 2007.



³⁴¹ H. Frumkin, *Environmental Health: From Global to Local*, John Wiley and Sons, 2010.

³⁴² Sundar, I. & Sezhiyan, I. *Disaster Management*, Sarup & Sons, 2007.

³⁴³ Ciotto, G. *Disaster Medicine*, Elsevier Health Sciences, 2006.

³⁴⁴ Miththapala, p, 13.

In conformance with some researcher definition of disaster resilience as “the ability of social units (e.g. organizations, communities) to mitigate hazards, contain the effects of disasters when they occur, and carry out recovery activities in ways that minimize social disruption and mitigate the effects of future disasters”³⁴⁵

The UAE is has taken various steps to ensure man-made disasters are prevented in various ways from a technical, organizational, social and economic perspective.³⁴⁶ From a technical view, the UAE is ensuring that all private and public physical systems are efficient and safe from any vulnerability to disasters. From an organizational view, the UAE is ensuring that private and public institutions are able to respond to any incidences and diagnose their potentials to degenerate to disasters. The social perspective enables he UAE to mobilize capacity to handling any man-made disasters and minimize their damages. Finally, from an economic view, the UAE is able to minimize the losses and ensure investors or business entities are back to operations within the shortest time³⁴⁷.

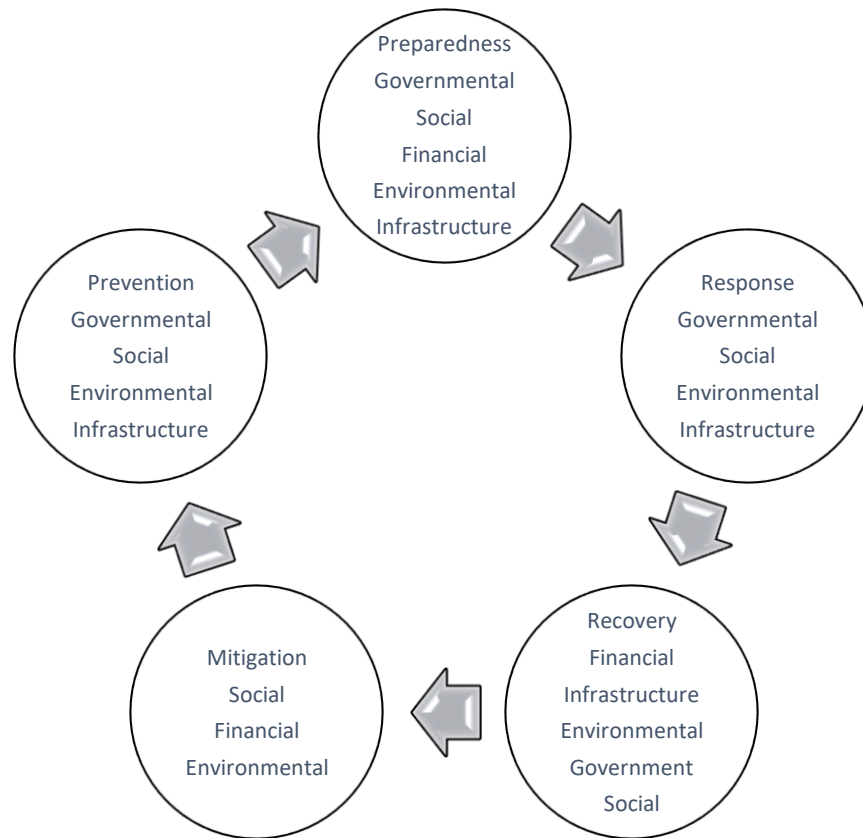
In achieving these disaster resilience strategies, the UAE anchors their risk management on the following five pillars: preparedness, protection, early warning, emergency response, recovery, and reconstruction³⁴⁸. The following figure illustrates the non- natural disaster management cycle.

³⁴⁵ M. S. E. Bruneau, R.T. Chang & G.C. Eguchi, et al. ‘A Framework to Quantitatively Assess and Enhance the Seismic Resilience of Communities.’ *Earthquake Spectra*, 19(4); 2003; p. 733–752.

³⁴⁶ S. Chang & M. Shinozuka, *Measuring Improvements in the Disaster Resilience of Communities*, Southern Methodist University, 2004, Retrieved http://lyle.smu.edu/emis/cmmi5/Ibarra/Desktop/2004_PhD_041406/Dissertation/Papers/Paper_CI/Incomplete_Paper_Disaster_Resilience.pdf

³⁴⁷ Chang & Shinozuka, Ibid.

³⁴⁸ Al Khaili, et al., p. 4.

Figure 42: Man-made Emergency Management Process

Source: NCEMA, 2007.

At the first pillar of preparedness³⁴⁹, the UAE organizations identify all possible dangers and their vulnerabilities using a risk assessment list that can also work as an earlywarning mechanism. This evaluation can be structured according to process flows or other relevant means and the staffs require prior trainings on how to hand different hazards. The organizations go further to insure their facilities and assets incase such man-made disasters were to occur.

At the second pillar of protection³⁵⁰, the UAE is emphasizing on safety codes and operational standards that will ensure human and property safety. Therefore, all organizations ensure the structural designs are sound and the machinery performance is up to standards that will not jeopardize the safety of the operators. Additionally, all the

³⁴⁹ Al Khaili, et al., p. 4.

³⁵⁰ Al Khaili, et al., p. 4.

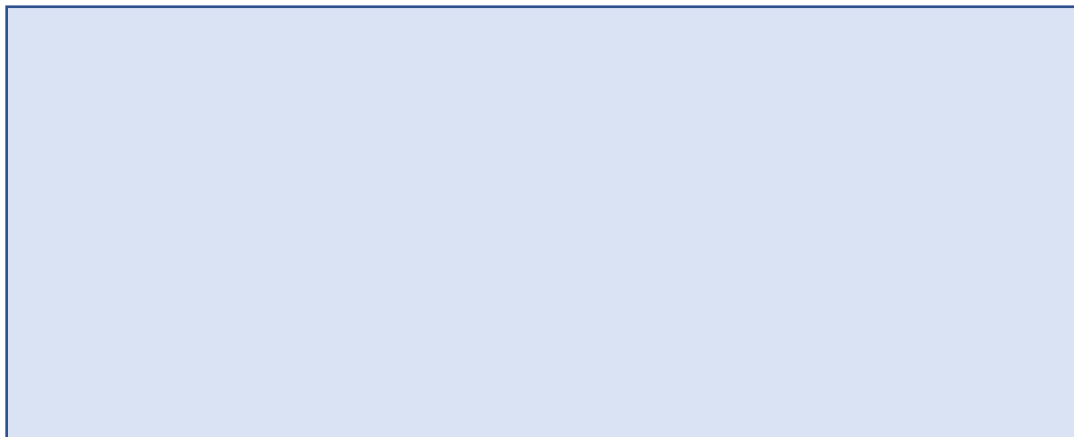
plant machinery is inspected regularly to ensure they are operating according to normal standards.

The third pillar of early warning³⁵¹ entails the UAE establishing ways of creating awareness to the private and public organizations about the possibilities of disaster occurring if certain steps are not followed. The objective of the early warning is to ensure the respective individuals of organizations create safety measures including procedure of evacuation from a hazardous scene and the temporary safety spots where people are supposed to assemble. This pillar also mandates the UAE to prepare logistical supplies that are easy to mobilize and dispatch to the disaster scenes within the shortest time.

The fourth pillar is the emergency response³⁵². At this stage, the UAE has developed various procedures that guide how difference agencies are supposed to respond to any man-made disasters. These procedures include when search, rescue and recovery should trigger following the initial phase of information. The objective of having an organized protocol for emergency response is to ensure that all roles are defined including relief supplies, medical ambulances and public communication. The UAE carries out regular drills to ensure the emergency response is working and to identify all the gaps that could pose challenges in a real scenario. The following is an early warning model³⁵³ that is citizen driven.

Figure 43: Citizens Driven Early Warning Systems for Man-Made Disasters

Source: ISDR, 2006.



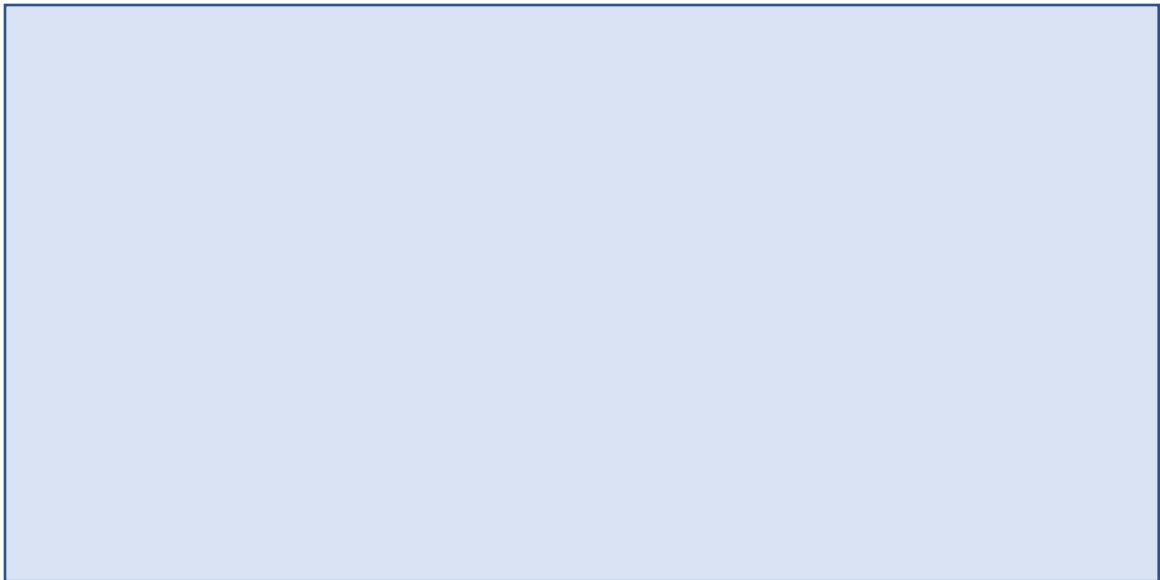
³⁵¹ Al Khaili, et al., p. 4.

³⁵² Al Khaili, et al., p. 4.

³⁵³ ISDR, *Global Survey of Early Warning Systems*, a report prepared at the request of the Secretary-General of the United Nations. Pre-print version released at the Third International Conference on Early Warning, Bonn, Germany, 27–29 March, 2006.

The final pillar is recovery and reconstruction³⁵⁴. The UAE budgets for indemnification of the damages depending on the causes and ownership as part of the government's commitment to post disaster reconstruction. Additionally, there are numerous private insurance firms in the UAE, which cover mostly individuals and private businesses to ensure they recover from the disaster within the shortest time. The insurance firms also offer the affected information on how to manage related risks in future. The following figure illustrates how specific man-made disasters should be mitigated from household levels to protection before the disaster escalates to worse levels.

Figure 44: The Recovery and Reconstruction Access Model



Source: Wisner, et al. 2003, p. 89.

³⁵⁴ Al Khaili, et al., p. 4.

***PART 3: DISASTER MANAGEMENT INSTITUTIONS IN
ABU DHABI***

CHAPTER 8: INTERNATIONAL ORGANIZATIONS CONCERNED ABOUT NON-NATURAL AND ANTHROPOGENIC HAZARDS

8.1 Introduction

Numerous regional and international organizations ensure the UAE disaster management goals are deliverable. These organizations work in the following areas during disaster management: “nutrition, health, water sanitation and hygiene (WASH), shelters, camp coordination and management, protection, early recovery, logistics, emergency telecommunications, food security and education”³⁵⁵. Among these international organizations are UNICEF, WHO, UNHCR, IFRC, UNFPA, UN Habitat, UNMAS, UNDP, FAO and WFP. The following table illustrates their areas of specialization.

Table 22: Regional and International Organizations for Disaster Management

Sector or Area of Activity	Global Cluster Lead
Nutrition	UNICEF
Health	WHO
Water sanitation, and hygiene (WASH)	UNICEF
Emergency Shelter	Areas of conflict: UNHCR
	Disaster situations: IFRC (Convener)*
Camp coordination & Management:	IDPs in conflict situations: UNHCR
	IDPs in disaster situations: IOM
Protection¹	UNHCR** Areas of responsibility: Child protection: UNICEF Gender-Based Violence: UNFPA and UNICEF Housing, Land and Property: UN-Habitat Mine Action: UNMAS
Early Recovery	UNDP
Logistics	WFP
Emergency Telecommunications	WFP
Food security	FAO and WFP (co-Leads)
Education	UNICEF AND Save the Children (co-leads)

Source: UAE& OCHA, 2015, p. 78

³⁵⁵ Ibid, p.80

8.2 The international organization and their action

- The World Health Organization (WHO)

The World Health Organization is involved in coordinating and managing health issues during disasters. Among the key mandates, the WHO ensures the populations are safe and health requirements provided as stipulated in the IASC. The WHO mobilizes all health stakeholders towards any alerted humanitarian crisis. The WHO further established healthcare priorities and resources according to the needs of affected population³⁵⁶.

The WHO offers collaborative services to various disaster management partners. These include disseminating information about the epidemiological status of a region of population, their risk status, emergency requirements, resource priorities and strategies for evaluating the recovery progress. WHO links the national, regional and cross border stakeholders whenever humanitarian situations face health disasters. The WHO also conducts rapid audits on the public health status to identify priorities and capacities of partners including needs for outsourcing³⁵⁷.

The WHO assesses³⁵⁸ the national and international partners' capacities to address the health crisis at hand. The WHO lays down strategies to ensure that disasters do not escalate to epidemic levels. This implies the WHO is a major operations organization whose objective traverses both technical and material relief. The WHO carries out research on the health situation of places that face natural or non-natural disasters to gauge their humanitarian gaps and the information is available on the WHO website. The following table illustrates the World Health Organization Developmental Agenda for the UAE.

³⁵⁶ UAE- Ministry of International Cooperation and Development & OCHA – United Nation Office for the Coordination of Humanitarian Affairs, p. 64.

³⁵⁷ Ibid, p. 65.

³⁵⁸ www.who.int/hac

Table 23: WHO – UAE Agenda for Disaster Management

WHO COUNTRY COOPERATION STRATEGIC AGENDA (2012-2017)	
Strategic Priorities	Main Focus Areas for WHO Cooperation
STRATEGIC PRIORITY 1: Health System Strengthening: Strengthening the health system and building national capacity in the Ministry of Health and Health Authorities; strengthening partnerships	• Strengthen and harmonize governance of the health sector (legislation, policy, strategies, norms, standards and regulations) • Strengthen and harmonize norms for accreditation of personnel and health facilities • Develop or strengthen national and emirate-level plans for education, training, recruitment and management of the health workforce • Strengthen primary health care and referral systems, particularly for provision of care for non-communicable diseases and mental health • Develop an integrated, flexible and sustained national health information system(s) capable of catering for information needs at all levels (local, district, emirate and national)
STRATEGIC PRIORITY 2: Promoting health through the Life Course approach: Collaborating on health-promoting schools and adolescent health; continuing collaboration on occupational and environmental health	• Establish a referral centre to be WHO collaborating centre on health-promoting schools and adolescent health to conduct research, develop approaches, guidelines and provide training • Establish a centre to develop and monitor a prevention program to reduce congenital anomalies and genetic diseases • Strengthen collaboration on occupational and environmental health for risk assessment and monitoring of drinking water quality, waste management and air quality
STRATEGIC PRIORITY 3: Expanding surveillance, prevention and control of non-communicable diseases; strengthening road safety and prevention of road traffic crashes and injuries.	• Strengthen prevention, monitoring and control for non-communicable diseases and cancer • Develop or strengthen cancer, diabetes and other diseases registries • Develop and implement program to reduce health risk factors • Commit to the establishing of reference centres for road traffic crashes and health-promoting schools
STRATEGIC PRIORITY 4: Strengthening prevention and control of communicable diseases.	• Strengthen prevention and control of communicable diseases • Develop a national centre for disease control to provide technical support for disease control programmes within primary health care especially in relation to epidemic and pandemics
STRATEGIC PRIORITY 5: Strengthening national capacity for health preparedness and response in emergencies and natural disasters	• Address the core requirements in relation to IHR in strengthening the national capacities of all areas related to IHR • Develop a health preparedness response and recovery plan including training plan of health professionals for response at all levels to emergencies and natural disasters

Source: *Global Health Observatory*, April 2014, p.2³⁵⁹.

- Office for the Coordination of Humanitarian Affairs (OCHA)

The United Nation Office for the Coordination of Humanitarian Affairs (OCHA) was established in December 1991 under the UN Resolution 46/182. The objective of the

³⁵⁹ *Global Health Observatory*, April 2014, Retrieved, <http://apps.who.int/gho/data/node.cco>

OCHA is to intercede during serious disasters and this body has created the Emergency Relief Coordinator (ERC). Therefore, OCHA and ERC conduct joint humanitarian assistance appeals during disasters including mobilizing financing³⁶⁰.

The OCHA convenes regular meetings for IASCs during disasters management period, chaired by the ERC. The Red Cross and Red Crescent Movements and other organizations depending on their value addition attend such meetings. The OCHA is further involved in sharing information about disasters including alerting partners and conducting rapid needs assessment. OCHA is mandated to call for relief assistance including Central Emergency Response Fund (CERF) and the ERFs³⁶¹.

OCHA is the central reference source where different relief issues are deliberated and mandates assigned to reach the population affected as best as possible. OCHA sets standards for humanitarian relief and addresses any problems facing partners. OCHA has programs for empowering the disaster-affected persons to avert similar disasters especially for the non-natural types. OCHA is at the proactive³⁶² in strengthening the ties among the disaster management and reduction partners and evaluates all impacts to ascertain the best intervention. OCHA has a disaster pre-evaluation team often dispatched to problem areas to advice on preliminary and subsequent relief requirements.

- The Inter-Agency Standing Committee (IASC)

The Inter-Agency Standing Committee (IASC) is very active whenever disasters hit anywhere. The IASC is concerned with liaison of operations, policy formulation and ratification of any resolutions emanating from the UN and its affiliate humanitarian organizations. The following is the IASC composition, FAO, OCHA, UNDP, UNFPA, UN-HABITAT, UNHCR, UNICEF, WFP and WHO. However, the IASC often calls upon the following for input on improving given disaster circumstances: ICRC, IFRC, International Council of Voluntary Agencies (ICVA), International Organization for Migration (IOM) and Office of the High Commissioner for Human Rights (OHCHR).

³⁶⁰ UAE- Ministry of International Cooperation and Development & OCHA – United Nation office for the Coordination of Humanitarian Affairs, *Responding to Emergencies Manual*, Volume 2, 2015, Retrieved, http://www.micad.gov.ae/PublicationsDLib/Responding%20to%20Emergencies%20Manual%202015/Responding%20to%20Emergencies%20Manual_V2%202015.pdf

³⁶¹ Ibid, p.58

³⁶² Ibid, p.58

Others are the Steering Committee for Humanitarian Response (SCHR), Office of the Special Rapporteur on the Human Rights of Internally Displaced Persons and the World Bank. IASC is always looking for ways to increase efficiency of relief outreach and impact to the people affected. Moreover, the IASC is coordinated all relief accountability issues³⁶³.

- United Nations Development Programme (UNDP)

The UNDP is a proactive disaster prevention organization whose mandate can extend to post disaster management operations. The UNDP has immense technical capability for assisting disaster-affected areas. The UNDP oversees the integration of development agendas so that any region or country affected by disaster can recover within the shortest time. The UNDP offers relief grants to people affected by natural disasters like floods, drought, Tsunamis, earthquake and others under a rapid initiative. The UNDP can use their own staffs or recruit locals depending on the scale of disaster to hasten the recovery process. The UNDP disburses their relief funds in different phases including urgent recovery efforts and trials for new developmental agenda. The UNDP liaises with the national and regional government to ensure all operations run on target and to minimize wastage of resources³⁶⁴.

- United Nations High Commissioner for Refugees (UNHCR)

The UNHCR was established following growing incidences of national and international refugees due to natural and non-natural disasters. The UNHCR is a rapid response initiative to avert disastrous humanitarian crisis involving displacement of populations. Therefore, the UNHCR provides the vulnerable and displaced persons with food, water, temporary shelter construction material, basic health and hygiene equipment, clothing and other essential amenities. The UNHCR keeps an inventory of relief materials that can be rapidly mobilized and distributed to disaster stricken populations.

³⁶³ UAE- Ministry of International Cooperation and Development & OCHA, p. 59.

³⁶⁴ UAE- Ministry of International Cooperation and Development & OCHA, p. 59.

The UNHCR often works with the national and regional government to distribute these materials³⁶⁵.

The UNHCR uses the following standard definition of refugee as stipulated by the UN Resolution 428 of December 1951³⁶⁶.

“Any person who, owing to well-founded fear of being persecuted for reasons of race, religion, nationality, or political opinion, is outside the country of his nationality and is unable or, owing to such fear or for reasons other than personal convenience, is unwilling to avail himself of the protection of that country; or who, not having a nationality and being outside the country of his former habitual residence, is unable to work, owing to such fear or for reasons other than personal convenience, is unwilling to return to it.”³⁶⁷

The UNHCR has mandate to protect all refugees falling under its care including persons seeking asylum from aggressive political states. Once any refugee is within the UNHCR compound or care, no government is allowed to force them to migrate anyway without their consent. The person is then under the UN High Commissioner for Refugees care in terms of material and welfare needs³⁶⁸.

- United Nations Children’s Fund (UNICEF)

UNICEF spends about 40% of its budget on disaster relief where children are vulnerable to different strife. These include extreme weather, warlike conditions, fires and other situations that put their welfare at risk. UNICEF endeavors to protect such children and their mothers to access basic needs and limit impact from conflicts. UNICEF protects children living with mothers internally or internationally displaced. UNICEF also supports children from problems like malnutrition and ailments during disasters and beyond. UNICEF protects children from all forms of violence and mistreatments that affect their physical and psychological wellbeing. Some of the abuses that children are exposed to, include armed conflicts, rape and labor exploitation. During disasters, UNICEF constructs temporary shelters, schools and healthcare to ensure their welfare.

³⁶⁵ Ibid, p. 60

³⁶⁶ Ibid, p. 60

³⁶⁷ UAE- Ministry of International Cooperation and Development & OCHA, p. 60

³⁶⁸ Ibid, 61.

Finally, UNICEF promotes family cohesions because that is the foundation for health, safe and protected children rights³⁶⁹.

- World Food Programme (WFP)

WFP is the leading UN body for distribution food to populations affected by disasters. WFP accomplishes this mandate by providing food aid to the prevent starvation and malnutrition among persons affected by disasters. Moreover, WFP aims are reducing effects of famine and poverty and supporting self-reliance on food security in the long term³⁷⁰.

To achieve its mandate, the WFP collaborates with the national and regional governments to project the humanitarian need for aid and strategize on its distribution. WFP responds to all emergency alerts for food aid and mobilizes their international resources to such courses. WFP has a robust logistical network that can reach many areas with people affected by shortage of food due to any form of disaster. Additionally, WFP can supplement food aid to populations with insufficient supplies due to disasters, whereby the population is on varied feeding programs³⁷¹.

WFP tracks its food distribution to ensure it reaches target populations whether delivered by air, road or water. Whenever WFP is unable to meet all its food aid demands, there is liaison with other partners with similar levels of relief services. However, during major disasters, WFP offers additional logistical services like bulk storage of food material and distribution at camps. Additionally, WFP can subcontract suppliers of food aid if the populations are living or camping at difficult terrains with bad access. Therefore, WFP can either provide cash to the population to buy food or provide food rations directly³⁷².

- Food and Agricultural Organizations (FAO)

During disasters, FAO collaborates with the WFP to distribute food materials and eliminate hunger among people affected. However, FAO's mandate is to limit the hunger

³⁶⁹ UAE- Ministry of International Cooperation and Development & OCHA, p. 61

³⁷⁰ Ibid, p. 62

³⁷¹

³⁷² UAE- Ministry of International Cooperation and Development & OCHA, p. 63.

or food shortage from degenerating to catastrophic levels. FAO programs are more elaborate because they involve affected populations increasing food production and reduce dependency on aid³⁷³.

Moreover, FAO is involved in prevention, strategy and information networks to the population about the food situation. Essentially, FAO has a Global Information and Early Warning System (GIEWS), which maps any urgent requirements for food aid. The field officers to increase the productivity and reduce the effects of hunger or lack of sufficient food stocks also use this system. FAO collaborates with agencies with similar objectives in improving food security and increasing productivity following disastrous events. FAO is also endowed with technical capacity for linking with other experts in food security and other dire situations. Finally, FAO has experts who can lead rehabilitation of areas affected by food shortages to come back to productivity³⁷⁴.

- National Red Cross and Red Crescent Societies

These societies offer very essential services during disaster times, working in collaboration with the International Red Cross and Red Crescent Movement. The National Red Cross and Red Crescent links the public and private organizations in mobilizing aid during disasters to alleviate suffering and other situations demeaning humanitarian status. This society is engaged in numerous humanitarian missions in areas of stress relief, healthcare and other social integration operations. This society is very flexible in activities and this explains why almost all the local, regional and international disaster relief agencies always involve them for primary collaboration³⁷⁵.

The National Red Cross and Red Crescent Movements collectively boast of more than 100 million volunteers and 300, 000 permanent employees globally. Every year, this society had assists over 233 million vulnerable people at concentrated or widespread scale, where the international partners are unable to reach or react following initial alerts for relief. The following are some of the programs by the National Red Cross and Red Crescent Society Movement³⁷⁶:

³⁷³ Ibid, p. 64

³⁷⁴ Ibid, p. 64

³⁷⁵ UAE- Ministry of International Cooperation and Development & OCHA, p. 66

³⁷⁶ Ibid, p. 67

- Providing community based healthcare services.
- Offering First Aid to injured persons during disasters
- Intervention and reduction of spread of diseases
- HIV / Aids management
- Provision of safe drinking water and good sanitary conditions.
- Provision of temporary shelters, non-edible materials, foods and drugs to affected people
- Providing information to the public about state of disaster.
- Coordinating blood donation to persons affected by disasters to ensure sufficient stocks on the bank.
- Reconnecting families who were separated due to disaster or conflicts.
- Promoting youth activities for wellness and volunteering during emergencies.

- International Federation of the Red Cross and Red Crescent Societies (IFRC)

Established in 1919 and currently having 183 national affiliations, the IFRC is responsible for managing relief during different types of disasters, including attending to internally displaced persons and any health issues. There are more than 60 IFRC delegations spread across the world for strategic purposes of speeding response for ongoing or vulnerable disasters. Furthermore, the IFRC is active in building social capacity for self-reliance after disaster period. The underlying objective of IFRC is to minimize any suffering of people due to any disaster and increases their survival rate. IFRC seeks to restore human dignity after undergoing stressful events during disasters³⁷⁷.

The IFRC has elaborate disaster response activation procedure depending on the capacity of its society. First, there is Emergency Appeal tool, which can be activated immediately a disaster arises and can be updated later for briefing other partners. This platform is very helpful for prompt fundraising³⁷⁸.

Second, the Field Assessment and Coordination Teams (FACT), which are flexible teams than can be sent to the disaster area in less than 6 weeks from the first alert. FACT has skilled workers who have international experience. Some of the skills include,

³⁷⁷ UAE- Ministry of International Cooperation and Development & OCHA, p. 67

³⁷⁸ Ibid, p. 68.

“emergency management and coordination, relief, logistics, health, nutrition, public health and epidemiology, water and sanitation, finance, administration, psychological support, restoring family links as well as many language capabilities.”³⁷⁹

FACT is expected to coordinate the initial activities of IFCR, provide rapid evaluation of the situation, map out an early action plan and indicate partnership needs. FACT is not limited to collaboration only with IFRC affiliates, but has prerogative of inviting other organizations as they deem fit from the rapid assessment reports³⁸⁰.

Third is the Regional Disaster Response Team (RDRT), which supplements the IFRC staff efforts during events. RDRTs are also expected to do a rapid assessment of the situation in collaboration with the National Red Cross and Red Crescent Society. Other than participating in relief tasks, the RDRTs can distribute food rations, construct shelters for IDPs and give media briefings³⁸¹.

Fourth is the Emergency Response Units (ERU), which is a rapid deployable to disaster areas. This ERU have standby staffs who can be airlifted to any place across the world and often have supplies that can last about four months at their disposal. The ERU are supported by other local organizations and must always be ready for any alerts. ERU come in handy when the local emergency units are unable to cope with the scale of disaster at hand. The ERU has expert staffs in logistical distribution of relief products and services. The ERU acts like the information link among the Red Cross and Red Crescent members. The ERU can provide treatment to about 600,000 litres of water to the WHO standards and this can serve about 40,000 people per day. The ERU has trucks and facilities for providing about 75,000 litres daily. In case the disaster is health related, the ERU can avail clean water drinking to 15,000 people per day. The ERU offers primary healthcare that can benefit nearly 30,000 persons daily. The ERU can provide referral medical care for a place with nearly 250,000 people. Finally, the ERU projects the relief needs and assesses their progress after various distributions³⁸².

³⁷⁹ UAE- Ministry of International Cooperation and Development & OCHA, p. 68

³⁸⁰ Ibid, p. 68

³⁸¹ Ibid , p. 68

³⁸² UAE- Ministry of International Cooperation and Development & OCHA, p. 68

- International Committee of the Red Cross (ICRC)

The ICRC, whose main officer is at Geneva, is mostly engaged during conflict related disasters. The ICRC enforces the Geneva Convention as ratified by the signatory nations that could be embroiled in conflicts. The ICRC ensures that the affected populations are safe from harm, access healthcare and other facilities required for their basic welfare. The ICRC is involved in locating lost relatives during conflicts and reuniting them, whether they are free, injured, in custody or prisoners of war³⁸³.

The ICRC is the creator of the Red Cross Movement and supports all persons irrespective of their role or side during conflicts. This implies that the ICRC can also attend to injured armed personnel during conflicts. The ICRC is not aligned politically, religiously and ideologically and this wins them trust from conflicting parties. Even though the ICRC collaborates with other agencies, it can still execute its mandate separately because of the designated personnel. ICRC can recruit medical personnel on the ground depending on the conflict. ICRC has independent sources of funding, even though it accepts donations from well-wishers³⁸⁴.

8.3 Treaties, Conventions, UAE Laws on Environmental Disaster Management

Whereas individual organizations and government are engaged in Environmental Impact Assessment (EIA), the efforts often need supplementation from independent bodies. These bodies are generally involved in quality assurance and monitoring, overseeing laws and regulations as different activities are executed by public and private individuals of organizations. Additionally, these bodies are active in research and technological implementation of ways that can minimize some of the risky operations that pose non-natural disasters over time³⁸⁵.

Most of the environmental laws that target pollution within the Arabian Gulf and the GCC are from the country laws, rules and regulations. The regional and international protocols or frameworks whereby respective nations ratify as a sign of their commitment

³⁸³ Ibid, p. 70.

³⁸⁴ UAE- Ministry of International Cooperation and Development & OCHA, p. 70

³⁸⁵ N, Khan, 'Integrated Management of Pollution Stress in the Gulf.' In: Abuzinada, A., Barth, H., Krupp, F., Boer, B., Al Abdessalaam, T. (Eds.), *Protecting the Gulf's Marine Ecosystems from Pollution*. Birkhauser, Verlag, Switzerland, 2008; pp. 27–92.

proactive disaster management support these laws³⁸⁶. Besides, the GCC nations are signatory to other international conventions that support prevention of pollution in the seas. However, the problem facing most of these bodies are enforcement related³⁸⁷. There is evidence that some GCC nations are more committed than others, yet when marine pollution occurs, the boundaries are nonexistent and impact is obvious to even non-offensive countries. Within the wider Asian regions, stronger enforcement of the laws and regulations to prevent pollutions has seen countries like Indonesia³⁸⁸ and Philippines³⁸⁹ reduce their heavy metal toxicities in their shorelines.

- Vienna Convention and Montreal Protocol

The UAE acceded to various international agreements and protocols to coordinate the reduction disasters. The Vienna Convention and Montreal Protocol were established in 1985, to safe guard human health and protect their surroundings from harm such as changes in the ozone layer stratosphere. The Vienna Convention was effective from September 22, 1988. The UAE signed the Vienna Convention on December 22 1989 before following up with the Montreal Protocol on February 16 2005. In so doing, the UAE issued two decrees: first Decree No. (13) of 1999, guiding the handling of substance that depletes the ozone stratosphere (ODS), mostly around CFS and Halons. Second, Decree No. (23) of 1999 to guild procedures of importing ODSs in to the United Arab Emirates. Therefore, the relevant UAE Minister has powers to levy extra charges to such an organization or individual. This Decree has made progress as by 2007, law prohibits CCL4 import into UAE³⁹⁰. Even though some environmental bodies are off track with their 2015 targets, others like the Montreal Protocol are making significant gains with the objective of restoring the ozone layer by 2050. The Montreal Protocol has been able to

³⁸⁶N. Khan & P. Price, 'Legal and Institutional Frameworks.' In: Khan, N., Munawar, M., Price, A. (Eds.), *The Gulf ecosystem: Health and sustainability*. Backhuys Publishers, Leiden, 2002.

³⁸⁷ H. El-Habr, Hutchinson, M. 'Efforts of regional and international organization in reducing levels of pollution in the Gulf.' In: Abuzinada, A., Barth, H., Krupp, F., Boer, B., Al bdessalaam, T. (Eds.), *Protecting the Gulf's Marine Ecosystems from Pollution*, 2008.

³⁸⁸ T. Hosono, C. Su, R. Delinom, Y. Umezawa, T. Toyota, S. Kaneko & M. Taniguchi, 'Decline in heavy metal contamination in marine sediments in Jakarta Bay, Indonesia due to increasing environmental regulations.' *Estuarine Coastline Shelf Science*, 92, 2011; pp. 297–306.

³⁸⁹ T. Hosono, C. Su, F. Siringan, A. Amano & S. Onodera, 'Effects of environmental regulation on heavy metal pollution decline in core sediments from Manila Bay.' *Marine Pollution Bulletin*, 60, 2010; pp. 780–785.

³⁹⁰ Environment Agency, *Policies and regulations of Abu Dhabi Emirate*, UAE, 2008, p. 17.

review the policies to include the banning of DDT and dioxins successfully and many Arab nations like the UAE have complied³⁹¹.

- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) was established to protect endangered species of animals and plants around the world. Over 30,000 endangered species are registered³⁹² under this convention, which was created on March 3, 1973 and implemented on July 1, 1975. The UAE ratified the CITES on February 1990 with the Decree of Federal law No. (11) of 2002.

- Basel Convention of Trans-boundary Movements of Hazardous Wastes

The Basel Convention of Trans-boundary Movements of Hazardous Wastes was established in the 1980s, and enforced in 1992. The Basel Convention enables countries monitor imports of hazardous materials or their wastes that have likelihood of polluting their environments or health risks to humans. The UAE signed the Basel Convention on November 17, 1992 under the Federal law No. (24) of 1999 and later as an executive order in December 2001. Article (62/1) of this law states that,

“no public or private party or qualified or unqualified persons are allowed to import or bring, bury or dispose of hazardous wastes in any form in the environment of the UAE”.³⁹³

- United Nations Framework Convention on Climate Change (UNFCCC)

The United Nations Framework Convention on Climate Change (UNFCCC) first met in 1979, “to foresee and prevent potential man-made changes in climate that might be adverse to the well-being of humanity”. These changes include the ability of man to introduce halocarbons and sulfides that have negative effects on the ozone layer. The UNFCCC was ratified during the Rio Earth Summits on March 21, 1994³⁹⁴. The Kyoto

³⁹¹ El-Raey, p. 7.

³⁹² Ibid, p. 18.

³⁹³ Ibid, p. 19.

³⁹⁴ Ibid, p. 19.

Protocol was established among member states on December 1997 to urge nations to be legally responsible for reducing greenhouse emissions by 5% on the benchmark of the 1990 level from 2008 to 2012 and to champion clean energy utilization. The UAE signed the UNFCCC on December 29, 1995 followed by the Kyoto Protocol on January 26, 2005. The UAE ratified the UNFCCC under the Ministerial Decrees No. (5/5) of 2000 and later No. (26) of 2005. Additionally, the UAE ratified the Kyoto Protocol under the Ministerial Decree No. (12) of 2006³⁹⁵.

Over the years, various human activities have been contributing to increase in greenhouse emissions, which eventually escalate to global warming. The wanton destruction of forests and combustion of the same yields a lot of carbon dioxide, which is a major component of greenhouse gasses. Similarly, other gasses like methane and nitrogen oxide emanating from agricultural operations contribute a great deal to greenhouse gasses. The effect is change in climatic patterns and the ensuing disasters are changes in global temperatures by a margin of 0.6°C since the last century³⁹⁶.

- United Nations Convention to Combat Desertification (UNCCD)

The United Nations Convention to Combat Desertification (UNCCD) was established in 1977, but ratified in December 26 1996 by UN member nations. The UAE signed the UNCCD on October 21, 1998 and the FEA was mandated to oversee its implications, under the Decree No. (20) of 2001. The UAE later amended its role in reducing desertification under the UNCCD in 2003, with a Decree No. (593/2) of 2003³⁹⁷, to be aware of the issues facing them for failure to combat the problems. Essentially, the UAE has various social and economic activities that have potential of aggravating the desertification problems in the country.

- Convention of Biodiversity (CBD)

The Convention of Biodiversity (CBD) is another body that has been working towards reducing man-made air pollution in the Arab region. The CBD was set up in 1992 during the Rio Earth Summit and enforced on December 29, 1993, to advocate for global

³⁹⁵ Ibid, p. 20.

³⁹⁶ Ibid

³⁹⁷ Abu Dhabi & UAE, Ibid p. 20

sustainable development. This convention was established on the 22nd Session of the Supreme Council in Oman, Saudi Arabia. The convention was established to preserve ecological environment and wildlife with attention to the endangered species that are shared within the GCC territories. The CBD aims at balance of nature so that the next generation can enjoy similar or more resources as found today. The UAE acceded to the CBD on February 10 2000 under the Decree No. (40) of 2004³⁹⁸. However, there are big challenges facing their agenda. For example, the UAE as a developing nation does not seem ready to slow down the use of hydrocarbon energy to curtail pollution and improve health standards because this could stagnate the economic growth. Additional challenge is that the rapid population growth in the UAE and the race for urbanization is putting pressure of the limited clean energy. Therefore, many people still rely on alternative energy sources that are major air pollutants³⁹⁹.

- Kuwait Regional Convention for Cooperation on Protection of Marine Environment from Pollution (ROPME)

The Kuwait Regional Convention for Cooperation on the Protection of the Marine Environment from Pollution was established to safeguard the marine environment and promote biodiversity. Eight nations subscribe as follows: Saudi Arabia, Oman, Qatar, Bahrain, UAE, Kuwait, Iraq and Iran. Later, the Regional organization for the Protection of marine Environment (ROPME) was instituted on July 1, 1979 to roll out the Kuwait Convention. The UAE signed the ROPME on December 1, 1979. As far as heavy metal pollution is concerned, the Regional organization for the Protection of marine Environment (ROPME) has guidelines for how industries need to treat wastewater and sewage before disposing of to the dry or wet environment⁴⁰⁰.

The ROPME was established in Kuwait and applies to various nations within the Arabian Gulf, including UAE. The ROPME bind the GCC nations to work towards minimizing marine pollution by offering standards for eliminating anthropogenic

³⁹⁸ Ibid, p. 21.

³⁹⁹ El-Raey, p. 7.

⁴⁰⁰ ROPME, Regional Organization for the Protection of the Marine Environment, *Guidelines for Management of Industrial Wastewater for the ROPME Region*. Kuwait, 2005a.

hazards⁴⁰¹. The ROPME is made up of the following three Protocols as applicable to the UAE,

“- Protocol Concerning Regional Cooperation in Combating Pollution by oil and other Harmful Substances in cases of Emergency, 1978.

- Protocol concerning Marine Pollution resulting from Exploration and Exploitation of the Continental Shelf, 1989.

- Protocol for the Protection of the Marine Environment against Pollution from Land-Based Sources, 1990.”⁴⁰²

Among the disasters that ROPME aims at averting are preventing pollution by oil to the marine environment including articulation the procedures for emergency intervention. Since most of the GCC member states have oil reserves or are producer, this convention was established to implement ways of minimizing its pollution incidences and impact. Some of the oil spillages common in the marine environment include pipe bursts, transport ship collisions, oil fires, explosions and other forms of leakages that predispose the environment to disaster⁴⁰³.

8.4 Regional Disaster Risk Management Organizations and Their Role in DRM

Various international, national and regional organizations and bodies have direct and indirect role in reducing disasters. In discussing each of these organizations especially within the GCC, UAE and Abu Dhabi, it would be useful to understand how they perceive the term disaster, hence, their intervention ideology and strategy⁴⁰⁴. The following table is a summary of the international and regional organizations engaged in disaster risk management.

⁴⁰¹ ROPME, Regional Organization for the Protection of the Marine Environment. *Guidelines on Sewage Treatment and Disposal for the ROPME region, Including Guidance for Submarine Outfall Structures*. Kuwait, 2005b.

⁴⁰² Environment Agency, *Policies and regulations of Abu Dhabi Emirate*, UAE, 2008, p. 22.

⁴⁰³ Abu Dhabi & UAE, Ibid p. 21

⁴⁰⁴ Ferris, E. & Petz, D. *In the Neighborhood: The Growing Role of Regional Organizations in Disaster Risk Management*. The Brooking Institution – London School of Economics Project on Internal Displacement. Brookings, 2013; Retrieved January 17, 2015, http://www.brookings.edu/~media/Research/Files/Reports/2013/02/regional%20organizations%20disaster%20ferris/REGIONAL_DISASTER_MECHANISMS_2013.pdf

Table 24: Regional Disaster Risk Management Organizations)

AFRICAN REGION	African Union (AU)
	Permanent Interstate Committee for Drought Control in the Sahel (CILSS)
	Community of Sahel-Saharan States (CEN-SAD)
	Common Market for Eastern and Southern Africa (COMESA)
	East African Community (EAC)
	The Economic Community of Central African States (ECCAS)
	Economic Community of West African States (ECOWAS)
	Inter-Governmental Authority on Development (IGAD)
	Indian Ocean Commission (IOC)
	Southern African Development Community (SADC)
AMERICAS REGION	Organization of American States (OAS)
	Central American Integration System (SICA)
	Caribbean Community (CARICOM)
	Association of Caribbean States (ACS)
	Andean Community of Nations (CAN)
	Southern Common Market (MERCOSUR)
ASIA REGION	Asian Ministerial Conference on Disaster Risk Reduction (AMCDRR)
	Asian Disaster Reduction Center (ADRC)
	The League of Arab States (LAS)
	Organization of Islamic Cooperation (OIC)
	South Asian Association for Regional Cooperation (SAARC)
	Association of Southeast Asian Nations (ASEAN)
	Asia-Pacific Economic Forum (APEC)
PACIFIC REGION	Secretariat of the Pacific Community (SPC)
	Pacific Regional Environmental Programme (SPREP)
	Pacific Island Forum (PIF)

Source: Ferris & Petz, p. 33-34.

In terms of disaster risk management, the world is represented in five regions and further into sub regions. First, Africa is made of 54 UN member nations with a population of 1.022 billion people by 2011. This is equivalent to 14.82% of the entire

world population⁴⁰⁵. The UNDP established the African Development Index (HDI) for the Sub-Saharan Region at 0.463⁴⁰⁶. The total number of recorded people affected disasters in the entire Africa from year 2000 – 2011 is 222,447,116. The number of people killed in these disasters from 2000 – 2011 is 16,449⁴⁰⁷ and this figure does not include all those who succumbed to drought because most government tend to suppresses the data. This is equivalent to 7.9% proportion of the entire world for people affected while the fatalities are equivalent to 1.48% globally. Overall, about 22.77% of Africa's population was affected by different types of disasters from 2000-2011, whereby the average GDP was \$3,107 from a total GDP of \$3.2 trillion⁴⁰⁸ and data for South Sudan was not available. The most active and resourceful regional body in Africa in disaster risk management is the African Union (AU), whereas there are others playing equally important roles on the same goals.

The main AU strategy is very articulate in terms of disaster risk management. The AU reaches out to member states politically to find ways of minimizing disaster risks in their respective nations. The AU is building international capacity to identify and evaluate disaster risks before they occur. The AU is training key member states representatives on how to reduce any disaster risks. The AU has different platforms for disseminating mass information about disaster risks. The AU is enhancing international governance and empowering their institutions on disaster risk minimization. Finally, the AU is coordinating the continents disaster risk to ensure their competence while reacting to any events⁴⁰⁹. All these efforts are under the umbrella of Africa Regional Strategy for Disaster Risk Reduction (2006-2015)⁴¹⁰. The following table is a summary of regional disasters, numbers of death, economic impact and other direct and indirect impact such as on the GDPs.

⁴⁰⁵ UN Population Division, Department of Economic and Social Affairs, World Population Prospects: The 2010 Revisions, File 1: Total population (both sexes combined) by major area, region and country, annually for 1950- 2100 (thousands), POP/DB/WPP/Rev.2010/02/F01, April 2011.

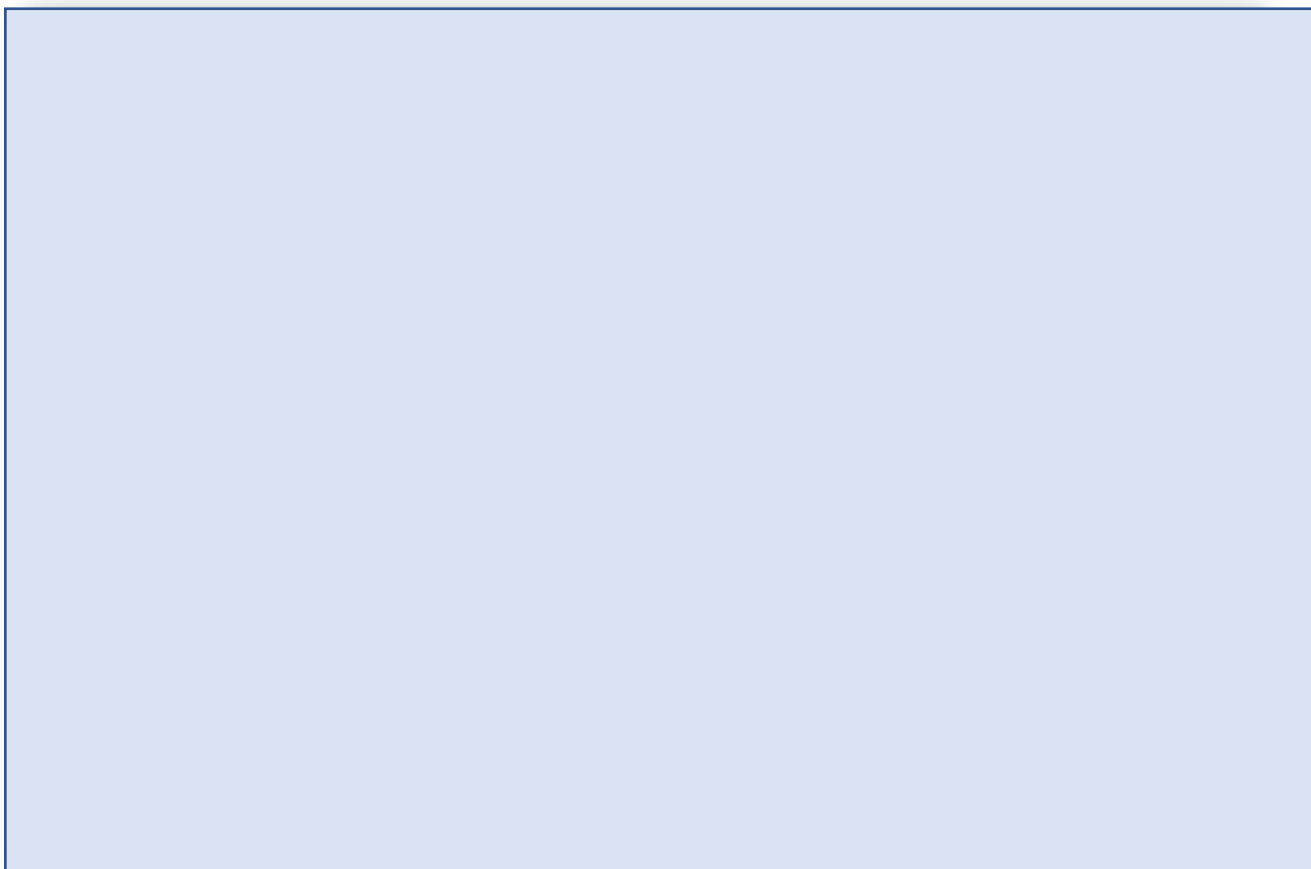
⁴⁰⁶ NDP, Human Development Index (HDI), 2011, Retrieved January 19, 2015
<http://hdr.undp.org/en/statistics/hdi/>

⁴⁰⁷ "EM-DAT: The OFDA/CRED International Disaster Database, www.emdat.be - Université Catholique de Louvain - Brussels - Belgium."

⁴⁰⁸ CIA World Factbook, "GDP Total (PPP)," Retrieved January 19, 2015,
<https://www.cia.gov/library/publications/the-worldfactbook/rankorder/2001rank.html>

⁴⁰⁹ AU, NEPAD, UNISDR, Africa Regional Strategy for Disaster Risk Reduction, July 2004, p. 1.

⁴¹⁰ African Union, *Programme of Action for the Implementation of the Africa Regional Strategy for Disaster Risk Reduction (2006-2015)*, Nairobi, 16 April 2010.

Table 25: African Region


Source: Ferris & Petz, 2013, p. 35.

The second region of interest in disaster risk management and reduction is Americas, with the biggest body being the Organization of American States (OAS)⁴¹¹. The Americas has 35 countries that are all UN member states. The total population by 2011 was 934.5 million which is equivalent to 13.55% of the entire world's population. The average Human Development Index (HDI) is 0.731 for Latin America and Caribbean and 0.910 for USA and Canada. The total GDP is \$23.76 trillion with the average per person being \$25,432. From 2000 to 2011, the entire Americas recorded population that was affected by different types of disasters is 94,842, 766. During the same period, the total number of deaths was 250,833 from the Americas. These data are equivalent to 3.37% of the global persons affected by disasters from the Americas while the casualties are

⁴¹¹ Article 1, Charter of the OAS. OAS, "Who we are," Retrieved January 19, 2015, www.oas.org/en/about/who_we_are.asp

22.60% of world's proportions. Overall, proportion of Americas affected by different forms of disaster is 10.15% from the regions total population⁴¹².

The Organization of Americas States was established in 1948 after members' accession to the Charter in Colombia's capital. The implementation of the Charter was in December 1951, even though various amendments have passed since that time. The OAS has a Department of Sustainable Development, which among other functions monitors the climate changes and urges its members to avoid operations that could result in natural disasters⁴¹³. Therefore, in 1999, the OAS created the Inter-American Committee on Natural Disasters Reduction (IACNDR) to administrate on natural disaster prevention and control efforts⁴¹⁴. In 2010, the OAS disbursed about US\$25,000 to the people of St. Vincent and Grenadines for their mitigation of Hurricane Tomas⁴¹⁵. The following table is a summary of regional disasters, numbers of death, economic impact and other direct and indirect impact such as on the GDPs.

⁴¹² Ferris & Petz, p. 49.

⁴¹³ Inter-American Network for Disaster Mitigation, "Strategic Objectives, accessed 22 August 2012, <http://www.rimd.org/documento.php?id=318>

⁴¹⁴ OAS, Department of Sustainable Development, "Inter-American Committee on Natural Disaster Reduction (IACNDR) and the Inter-American Strategic Plan for Policy on Vulnerability Reduction, Risk Management and Disaster Response (IASP)," 29 September 2010, Retrieved January 19, 2015, www.oas.org/dsd/Nat-Dis-Proj/Natdesproject/InterCommit.htm

⁴¹⁵ Permanent Mission of St. Vincent and the Grenadines to the Organisation of American States, "Press Release," 10 November 2010.

Table 26: The Americas


Source: Ferris & Petz, 2013, p. 49.

The third region of interest in disaster risk management is Asia, whereby the biggest Asian Ministerial Conference on Disaster Risk Reduction (AMCDRR)⁴¹⁶. Asia is made of 44 nations all being UN member states. The total population by 2011 was 4.15 billion which is equivalent to 60.38% of the world's proportion. The total GDP for Asia is US\$30.7 trillion with the average per person being \$7,392. From 2000-2011, Asia had 2,485,523,225 people affected by different types of disasters. The number of people who died from these disasters within the same period was 701,606. These figures of people affected by disasters are equivalent to 88.27% of the world's population and 63.24% for

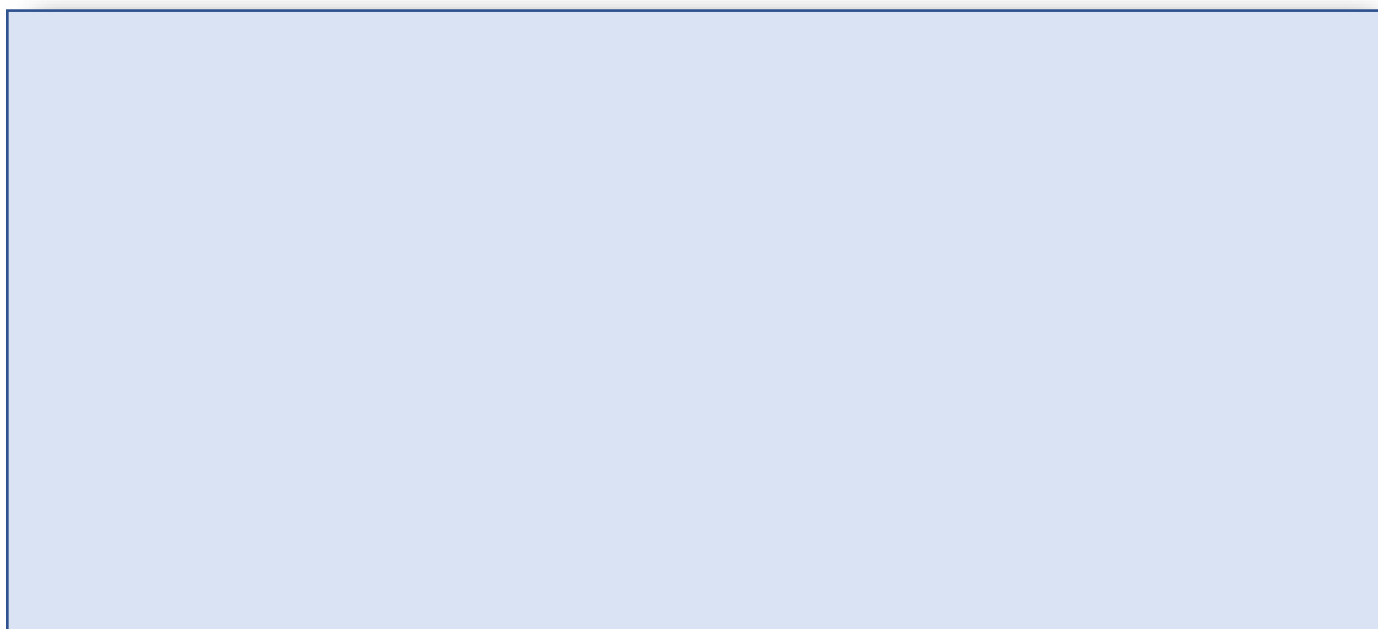
⁴¹⁶ BNPB, "5th Asian Ministerial Conference on Disaster Risk Reduction," Retrieved January 19, 2015, <http://5thamcdrr-indonesia.net/about-5th-amcdrr/>

the global proportions who died from the same. Overall, Asia had 59.7% of people who were affected with disasters as a proportion of the region's population⁴¹⁷.

The AMCDRR meet every two years under a rotational chair from 2005 to deliberate on the regions disaster risk management under the Hyogo Framework for Action (HFA). These meetings provide member Ministers with change to strengthen their commitment and work toward realization of the main goals. The AMCDRR impresses upon the member states to implement their local strategies at national level⁴¹⁸.

The Asian Disaster Reduction Center (ADRC) is another body that coordinates disaster risk management among 29 member states. This center is based at Kobe in Japan and its establishment in 1998 was to unite nations to foster sustainable development and prevention of disasters. In order to strengthen the member countries skills and knowledge, there is a strong exchange program⁴¹⁹. The following table is a summary of regional disasters, numbers of death, economic impact and other direct and indirect impact such as on the GDPs.

Table 27: Asia



Source: Ferris & Petz, 2013, p. 63.

⁴¹⁷ Ferris & Petz, p. 63

⁴¹⁸ UNISDR, *Hyogo Framework for Action 2005-2015, Building the Resilience of Nations and communities to Disasters, mid-term review, 2010-2011*, March 2011, p. 50.

⁴¹⁹ ADRC, "Mission and Objectives," accessed 29 August 2012, <http://www.adrc.asia/aboutus/index.php>

The ADRC has various activities. First, under the information collaboration functions, the ADRC offers data and projections to the member states on the coming or ongoing disasters including how they can prepare and minimize effects. This role is accomplished using a matrix called Global Unique Disaster Identifier (GLIDE). There is a Disaster Management Support System (DMSS) run by the ADRC to oversee all the projects and provide relevant information. The final source of information from the ADRC is via member state conferences⁴²⁰.

Second, the ADRC is focused on Human Resource Development. Under this activity, ADRC organizes seminars and workshops to update the personnel knowledge of disaster risk reduction strategies. ADRC often brings external experts on the discipline of disaster risk reduction to reinforce the trainings to and strengthen the human resource capacity⁴²¹.

Third, ADRC is committed to enhancing member states capabilities. This activity is accomplished by the creation and sharing of needs for local communities to take their roles in disaster risk reduction seriously. ADRC collaborates with the Asian Disaster Reduction and Response network (ADRRN) as an example of strengthening community capacity. The ADRC joins hands with the United Nations Office for the Coordination of Humanitarian Affairs (UN OCHA) who subscribe to the ADRRN. Finally, the ADRC collaborates with non-governmental organizations to improve the response time and capacity to regional disasters. The outcome of communal capacity building at all these levels is so far very satisfactory⁴²².

By 2012, the central Asia lacked a key regional body overseeing the disaster risk management. Nevertheless, the World Bank and the UNISDR working in collaboration with other stakeholders have established the Central Asia Regional Economic Cooperation (CAREC) to fast track the Hyogo Framework for Action 2005-2015 on minimizing disaster risks. The following are the functions for the collaborative framework. First, to unify the disaster intervention and preparedness activities. Second, to compensate disaster victims and damages including supporting their processes towards

⁴²⁰ ADRC, "Activities," accessed 29 August 2011, <http://www.adrc.asia/project/index.php>

⁴²¹ Ibid

⁴²² Ibid

recovery in liaison with insurance organizations. Third, disseminating metrological information about changes in weather and indicating any impending disaster risks⁴²³.

Still under the Asia region is the Middle East sub region made up of 22 nations. The biggest regional disaster risk management is the League of Arab States (LAS)⁴²⁴. The population for the Middle East by 2011 was 357 million, equivalent to 5.17% of the world population. The Middle East GDP was \$3 trillion with the average per person being \$8,448. The total number of people affected by disasters in the Middle East from 2000 – 2011 was 23,670,709 while 6,694 lost their lives during the same period. The proportion of Middle East population affected was 0.84% compared to the rest of the world while the deaths are 0.6% on global scale even though this figure does not capture all the drought fatalities. Overall, the different types of disasters affected 6.6% of the Middle East population as a proportion to the worlds affected⁴²⁵.

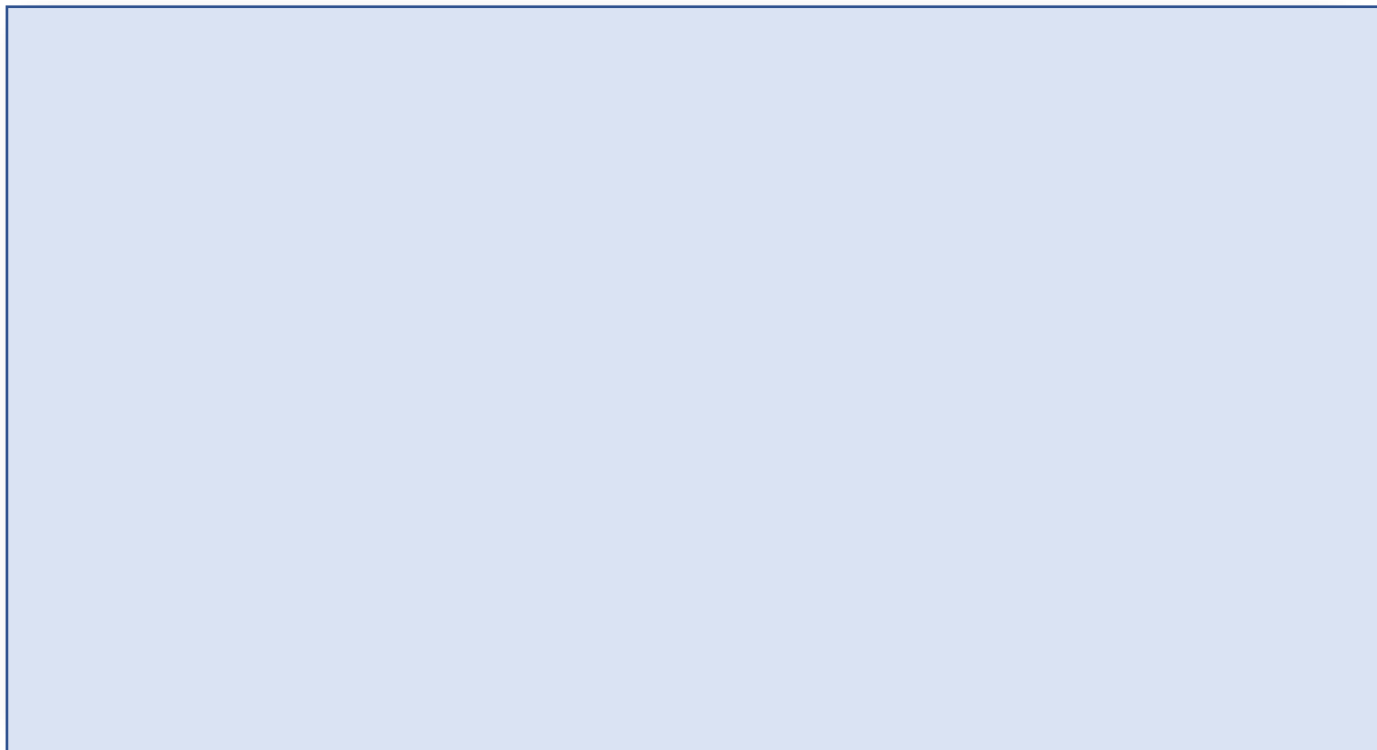
The League of Arab States (LAS) was established in 1945 and the head quarter is Cairo, Egypt. The Leagues interest in disaster relief operations was revitalized in 1990, following the signing of the Arab Cooperation Agreement Organizing and Facilitating Relief Operations (ACOFRO). Later in 2005, LAS outlined how Arab states should respond to disasters in their respective nations, under the oversight of the Council of Arab Ministers Responsible for the Environment (CAMRE)⁴²⁶. The following table is a summary of regional disasters, numbers of death, economic impact and other direct and indirect impact such as on the GDPs.

⁴²³ NDP, “Republic of Kazakhstan, Disaster Risk Reduction Review,” July 2009.

⁴²⁴ E. M. Fatma, “Key Achievements and DRR Priorities within the League of Arab States system,” PowerPoint Presentation, Retrieved January 20, 2015, www.preventionweb.net

⁴²⁵ Ferris & Petz, p. 63

⁴²⁶ Fatma, Ibid.

Table 28: Middle East


Source: Ferris & Petz, 2013, p. 63

The LAS often gets their technical assistance from the United Nations Environmental Program (UNEP) following an agreement in 1986 under a common office called the Arab League Liaison Office (ALLO) based in Cairo, Egypt⁴²⁷. Under this agreement, CAMRE and UNEP conducted a study on the common disasters that affect the Middle East as an Asia sub region. Some of the Memorandum of Understanding signed includes Regional Conservation Organization for the Environment of the Red Sea and Gulf of Aden (PERSGA) and the Regional Organization for Protection of the Marine Environment (ROPME). These MoU enable the LAS and supporting organizations to mobilize their resources and minimize wastages occasion by different bodies duplicating the same task. The MoU also enables the disaster risk management players to prioritize operations. In 2010, CAMRE rolled endorsed the Arab Strategy for Disaster Risk Reduction, which has

⁴²⁷ Fatma, Ibid

a vision 2020⁴²⁸. Later in 2011, LAS participated in the creation of Arab Center for Prevention of Earthquakes and other natural Disasters Risks with the headquarters in Algeria⁴²⁹.

The fourth major regional block organized for disaster risk management is Europe, with 49 UN member countries. By 2011, Europe had a population of 754 million, equivalent to 10.7% of the global population. The average Human Development Index for Europe is 0.751. The total GDP by 2011 was \$19.4 trillion with average per person being \$26,351. The total number of people affected by disasters from 2000 – 2011 was 11,301,450 equivalent to 0.40% of the global incidences. The total number of people who died from these disasters from 2000 – 2011 was 139,116, equivalent to 12.53% of the global fatalities. Overall, Europe's disaster affected population is 1.53% the entire regions population⁴³⁰.

One of the biggest regional disaster risk management body is the Organization of the Black Sea Economic Cooperation (BSEC), established in 1992 with headquarter at Istanbul, Turkey. BSEC has 12 member nations. From its inception, BSEC member states ratified Collaboration in Emergency Assistance and Emergency Response to Natural and Man- Made Disasters for coordinating all related affairs. Among the disaster issues that BSEC addresses are those arising from earthquakes, wild fires and flush floods⁴³¹. The following table is a summary of regional disasters, numbers of death, economic impact and other direct and indirect impact such as on the GDPs.

⁴²⁸ United Nations Environment Programme, "UNEPs work," Retrieved January 20, 2015, <http://www.unep.org/environmentalgovernance/UNEPsWork/Multilevelsupport/tabid/420/Default.aspx>

⁴²⁹ Ferris & Petz, p. 67.

⁴³⁰ Ferris & Petz, p. 77.

⁴³¹ Ministry of Foreign Affairs of the Republic of Armenia, "Black Sea Economic Cooperation," accessed 29 August 2012, <http://www.mfa.am/en/international-organisations/BSEC/>

Table 29: Europe


Source: Ferris & Petz, 2013, p. 77.

The next major regional disaster risk coordination body is Council of Europe (CoE) with 47 UN state members and headquarters in Strasbourg, France. The CoE was established in May 5th 1949 initially as a human rights lobby body. However, from 1987, the CoE mandate expanded to include disaster risk detection, prevention and evaluation. The current issues of focus for CoE include policy formulation and risk awareness, integrating science and technology to coordinate disaster risk assessment and interventions and creating timely disaster warning mechanisms⁴³².

The European Union (EU) is the key structure for economic sustainability and political lobbying in Europe, since 1993 when the Treaty of Maastricht established it. The Title of Civil Protection accomplishes most of the disaster risk management works of the

⁴³² Council of Europe, “European and Mediterranean Major Hazards Agreement (EUR-OPA), Medium Term Plan 2011-2015,” 28 September 2010.

EU. The EU coordinates disaster risk assessment, limitation and intervention by sharing data and information with the public pre or post disaster⁴³³.

The EU has clear procedures for assisting member nations whenever they face any form of disaster. These steps called IFRCs, fall under four major categories, disaster planning, coordination, logistics and finance and legal implications. Therefore, it is clear that procedures⁴³⁴ were developed to enable the EU address previous gaps in disaster risk management by respective nations. Therefore, the EU saw need for a unified framework that includes collaboration of information and standardizing practice⁴³⁵.

In the most recent revised functions of the EU in 2011 on the disaster risk management, the following are the areas of engagement⁴³⁶. First, the EU created a 24/7 Emergency Call Center to improve communication and intervention in any related situation. From this center, the EU can mobilize resources and receive donations from members and beyond in response to any disaster. Second, the EU established system where member countries can offer assistance either immediately or in pledges to improve their capacity to respond to disasters. Third, the EU has an elaborate plan for training member countries on how to handle different types of disasters⁴³⁷. Additionally, the EU ranks third among the financial contributors within the UNISDR with their provision of \$19 million from 2000 to 2011. The EU is also involved in financial assistance to member nations facing different proportions of disasters⁴³⁸. So far, the EU is second to the UN in terms of humanitarian financial assistance. In 2002, the EU provided \$1.7 billion to alleviate disaster risks in different nations⁴³⁹.

⁴³³ European Commission, "A Community approach on the prevention of natural and man-made disasters," Communications from the Commission of the European Commission, Brussels, 23 February 2009; and Interview with Yordanka Mincheva, 18 October 2012.

⁴³⁴ H, Katherin & F, Conor, *International Dialogue on Strengthening Partnership in Disaster Response: Bridging national and international support*, Background Paper 2 Regional and International Initiatives, Humanitarian Outcomes, September 2011, p. 27.

⁴³⁵ European Commission, Humanitarian Aid & Civil Protection, "Prevention," 1 December 2011, Retrieved January 20, 2015, http://ec.europa.eu/echo/civil_protection/civil/prevention_overview.htm

⁴³⁶ Hyogo Framework for Action, *Implementing the Hyogo Framework for Action in Europe: advances and challenges 2009-2011*, 2011, retrieved January 20, 2015, www.preventionweb.net/english/professional/publications/v.php?id=19690&pid=0, p. 90.

⁴³⁷ Commission of the European Union, "Moving closer to more effective disaster management in Europe," MEMO/11/927, 20/12/2011.

⁴³⁸ UNISDR, "Donor Partnerships, Biennial Contributions, 2010-2011," Retrieved January 20, 2015, <http://www.unisdr.org/who-we-are/donors>

⁴³⁹ Development Initiatives, *Global Humanitarian Assistance Report 2012*, 2012, p. 13.

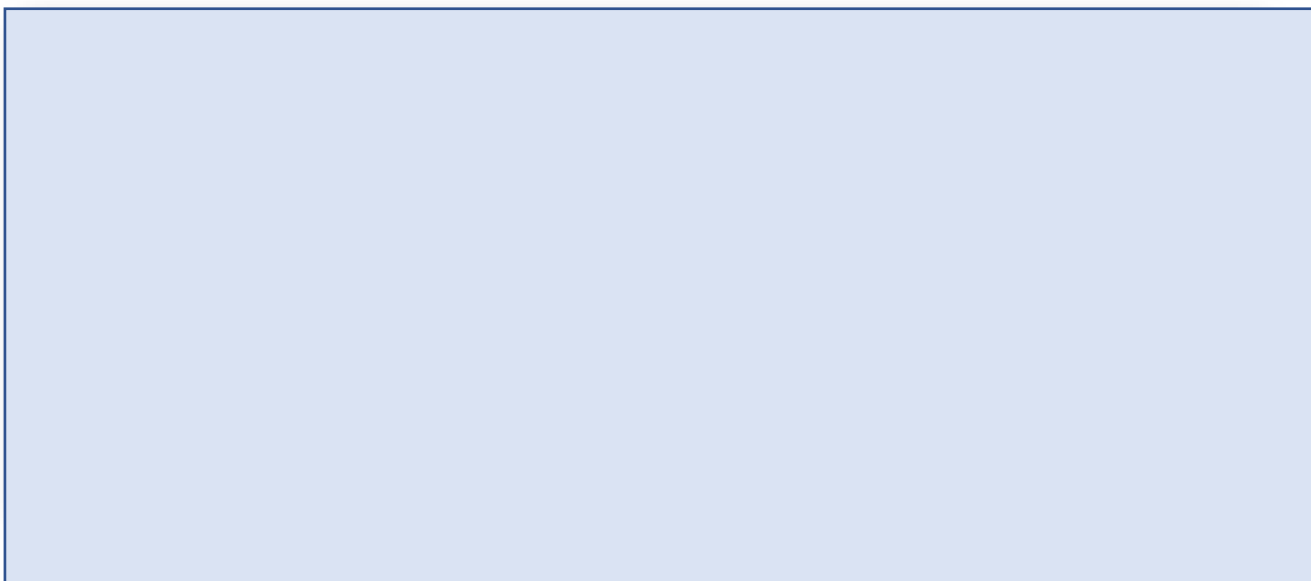
The North Atlantic Treaty Organization (NATO) is a sub-regional disaster risk management body, established in 1949 initially as a military intervention strategy in global and civil strife stricken nations around that region. The NATO had 28 members by 2011. In the most recent operations, NATO was activated to duty in Bosnia, Kosovo, Afghanistan and Libya. Their role was to intervene militarily and prevent any potential humanitarian disasters from warring factions or sides⁴⁴⁰.

Later the NATO mandate was expanded to include relief to include relief from different disasters such as harsh weather, drought, pollution and any other causal factors as can be determined. NATO is the main coordinator of the Euro-Atlantic Disaster Response Coordination Centre (EADRCC), which was established in 1998. The EADRCC is supported by another 22 nations who are not NATO member states. EADRCC approves disaster response requests from all the affiliate nations.

The fifth major disaster management region is the Pacific, with 24 nations that are UN members. By 2011, the total population was 36.59 million, equivalent to 0.53% of the global population. The average human development index is 0.685. The Pacific GDP by 2011 was \$1.09 trillion with the average per person being \$29,706. The number of people affected by disasters from 2000 to 2011 is 1,506, 368, equivalent to 0.05% of the global cases. Additionally, the number of people who perished from these disasters during the same period is 1,498, equivalent to 0.14% of the global cases. Overall, the Pacific region had 4.12% of people affected by different disasters⁴⁴¹. The following table is a summary of regional disasters, numbers of death, economic impact and other direct and indirect impact such as on the GDPs.

⁴⁴⁰ NATO, "A short history of NATO," Retrieved January 20, 2015, <http://www.nato.int/history/nato-history.html>

⁴⁴¹ Ferris & Petz, p. 86

Table 30: Pacific


Source: Ferris & Petz, 2013, p. 86

The South Pacific Applied Geosciences Commission (SOPAC) is among the most active bodies that work on disaster risk management⁴⁴². Established in 1972, the SOPAC is committed to reducing all forms of disasters. The SOPAC offers various disaster management organizations a platform to collaborate and complement each other's capacity⁴⁴³. The earlier tasks accomplished by SOPAC were in marine areas. However, these tasks were recently in 2011 expanded to cover other areas with potential of disasters such as land, oceans, energy, water and hygiene. The latest engagements of SOPAC include disaster reduction under the Pacific Islands Framework for Action on Climate Change 2006 – 2015⁴⁴⁴; the Ocean and Island programs and the water and sanitation programs.

⁴⁴² SOPAC, "SOPAC Overview," 29 March 2010, Retrieved January 20, 2015, <http://www.sopac.org/index.php/sopac-overview>

⁴⁴³ SOPAC, "Implementation of the Hyogo Framework for Action and the Pacific Disaster Risk Reduction and Disaster Management Framework for Action 2005 – 2015, Regional Synthesis Progress Report. Report for the period 2007 – 2009, June 2009, p. 9.

⁴⁴⁴ SOPAC Overview, Ibid.

CHAPTER 9: GCC, UAE AND ABU DHABI DISASTER ADMINISTRATION AND MANAGEMENT SYSTEM

9.1 Introduction

In the context of disaster administration and management, it is necessary to have an overall understanding of the governance and administrative support structures of UAE. In case of a disaster, various agencies of the government plunge into action and proper coordination and interface among them is of utmost importance. In some cases, cooperation from and mutual assistance may be required from the neighbouring countries. Therefore, regional cooperation in matters of transnational disaster management is essential. In the following paragraphs, the various mechanisms available for the administration and management of disaster in the GCC region are presented.

9.2 The GCC Disaster Administration and Management Body

The biggest regional disaster risk management body for the 22 nations in the Middle East sub-region is the League of Arab States (LAS). The League of Arab States (LAS) was established in 1945 and the head quarter is Cairo, Egypt. The Leagues interest in disaster relief operations was revitalized in 1990, following the signing of the Arab Cooperation Agreement Organizing and Facilitating Relief Operations (ACOFRO). Later in 2005, LAS outlined how Arab states should respond to disasters in their respective nations, under the oversight of the Council of Arab Ministers Responsible for the Environment (CAMRE).

The LAS often gets their technical assistance from the United Nations Environmental Program (UNEP) following an agreement in 1986 under a common office called the Arab League Liaison Office (ALLO) based in Cairo, Egypt . Under this agreement, CAMRE and UNEP conducted a study on the common disasters that affect the Middle East as an Asia sub region. Some of the Memorandum of Understanding signed includes Regional Conservation Organization for the Environment of the Red Sea and Gulf of Aden (PERSGA) and the Regional Organization for Protection of the Marine Environment

(ROPME). These MoU enable the LAS and supporting organizations to mobilize their resources and minimize wastages occasion by different bodies duplicating the same task. The MoU also enables the disaster risk management players to prioritize operations.

9.3 The UAE Disaster Administration and Management System

UAE has a robust disaster administration and management system. Each function has a specific protection mandate as outlined by the Higher Environmental Committee in 1975 following a Cabinet Decree No. 13. This function is composed of government agencies and private sector that in ordinary circumstances are expected to ensure that there abiding with law to avoid issues that can cause man-made disasters. The committee has mandate to coordinate recovery efforts during any natural disaster operations. Overall, the administration of disaster risk management in Abu Dhabi and UAE is guided by the nation's environmental laws, health and safety systems as the pillar of local and regional protection and compliance⁴⁴⁵.

9.3.1 The UAE Municipality

In the UAE, every municipality has a mandate of managing disaster risks as entrenched in the environmental laws. Therefore, every municipality is expected to coordinate their activities proactively to prevent man-made disaster and to minimize the negative impacts of the natural disasters. This power and mandate to the respective municipalities is supported by the Federal Agency, which was set up in 1980. The mandate was further strengthened following the Earth Summit in Rio Brazil in 1992 where all nations were impressed upon to improve their capacity to handle disasters and any other environmental degradation events⁴⁴⁶. The following is a map of how UAE disaster management is organized:

In order to accomplish respective administrative mandates on the environmental protection and disaster management, the following institutions exist in the UAE:

- Ministry of Environment and Water (previously Ministry of Agriculture & Fisheries), UAE

⁴⁴⁵ Abu Dhabi & UAE, *Policies and Regulations of Abu Dhabi Emirate, United Arab Emirates*. 2006, Retrieved January 18, 2015,

<http://www.agedi.ae/Pages/pdf/6%20Pollution%20and%20Regulations.pdf>

⁴⁴⁶ Ibid, p. 10.

- The Federal Environmental Agency, UAE, 1993 (The executive arm of the Ministry)
- Environmental Research and Wildlife Development Agency (ERWDA), Abu Dhabi Emirate, 1996 (Renamed in 2005 to “Environment Agency-Abu Dhabi”)
- Environment and Protected Areas Authority, Sharjah Emirate, 1998.
- Environment Protection and Industrial Development Authority, Ras Al Khaimah Emirate, 1999.
- Environment Departments at Dubai, UAQ, Ajman and Fujairah Municipalities⁴⁴⁷.

9.3.2 The Federal Environmental Agency (FEA)

There are two main environmental institutions in the UAE. First is the Federal Environmental Agency (FEA), which was set up by the Federal Law No. (7) of 1993 and later amended by Law no. (30) of 2001 and Law no. (20) of 2004. Generally, FEA executes its mandate as an independent body and has a budgetary provision approved by council of Ministers in the UAE⁴⁴⁸.

FEA has several objectives⁴⁴⁹. First FEA oversees the protecting and sustaining the UAE environment. Second, FEA oversees the planning and policy implementation of all safe operation that prevent disaster in the environment whether water, land, air, wildlife and other categories of flora and fauna. Third, FEA roles out activities that ensure the environment are protected from disasters or any form of degradation. Fourth, FEA fights against activities that pollute the environment and destabilize the balance of nature and other nature’s survival.

FEA ratified the Federal Environmental Law No. (24) of 1999 with regard to Protection and Development of the Environment, including from natural and man-made disasters. This Law has about 101 articles that focus on the specific environmental aspects that need protection including from disasters. This law outlines how different forms of disasters whether from pollution, dangerous substances and gasses are handled. In order to prevent various forms of disasters, FEA invokes Executive Order, which covers these regulations “Management of pesticides, agricultural additives and fertilizers;

⁴⁴⁷ Ibid, p. 10

⁴⁴⁸ Abu Dhabi & UAE, Ibid p. 10

⁴⁴⁹ Ibid

protection of the marine environment; handling of hazardous substances, hazardous wastes and medical wastes; protection of air from pollution.”⁴⁵⁰

The development of the Federal Environmental Law No. (24) of 1999 started in 1994, then first decreed in 1995 and later amended to address all the important disaster concerns. The Law No. (24) came into effect in February 2000. Later FEA was actively engaged in the development of the “UAE National Environmental Strategy and National Environmental Action Plan” in collaboration with all the interested parties and stakeholders to advance administration and management of disasters⁴⁵¹.

9.3.3 The Environment Research and Wildlife Development Agency (ERWADA)

The second main environmental institution in the UAE is the Environment Research and Wildlife Development Agency (ERWADA). The Abu Dhabi Emirates Law No (4) of 1996 decreed this agency. An amendment in June 2005 of Law No (16) reorganized the functions of the ERWDA and gave it more powers to oversee environmental issues. Hence, ERWDA acquired a new name as Environmental Agency- Abu Dhabi (EAD)⁴⁵².

9.3.4 The Abu Dhabi Executive Council

Recently, the Abu Dhabi Executive Council updated their priorities for disaster risk management. The policy running from 2009 – 2013 covered various areas. First was the clarion call to better water quality and increase supplies. Second was to enhance good air quality. Third was to adapt to the best practices that prevent rapid climate change. Fourth was to establish a waste management system that is sustainable to all. Fifth was to ensure the society is safe from all forms of environmental pollution from hazardous substances. Sixth was to ensure that any sort of disaster does not jeopardize the balance of Abu Dhabi’s biodiversity. Seventh was to create better awareness on the needs for conserving the environment. Eighth was to promote health and safety practices that are geared towards conserving the environment. Ninth was to monitor how organizations work towards best practices that eliminate potentials of disasters in the environment including use of technology. Tenth, to update public knowledge about the environmental pollution,

⁴⁵⁰ Ibid

⁴⁵¹ Ibid

⁴⁵² Ibid

health and safety practices by use of available human resources. Finally, to enhance inter-organizational collaboration to coordinate and communicate all the above stated functions⁴⁵³.

9.3.5 The Abu Dhabi Business Disaster Preparedness Mechanism

When businesses endeavor to have set up a disaster response functions, it is advisable to follow some laid down procedures. The first phase is planning. Under this phase, the Abu Dhabi businesses are mandated to select the best site with utmost awareness of its safety and vulnerability to disasters. Additionally, the business must gather and evaluate the views of the surrounding community whether health or impact related, so that they can ensure least disruption of their food, air and water safety. Previously, some businesses have had to deal with basic public health issues like Cholera, Malaria, AIDS and other food and water borne diseases. Next, the business must ensure that appropriate designs are champions in terms of embracing green concepts, stability, material conservation and durability⁴⁵⁴.

In the second phase, the Abu Dhabi business must establish a rapid response team, which can incorporate the local community. In order for this team to work efficiently, businesses must set aside sufficient funds whether from internal or external sources⁴⁵⁵. Moreover, the fund allocation for disaster preparedness must be used innovatively with utmost accountability⁴⁵⁶.

The third phase for Abu Dhabi business disaster preparedness is leadership. Most disasters tend to spiral out of control because of poor leadership and coordination. Related to leadership is the business sound governance, which will ensure that the processes get back to normal within the shorted time and with minimal negative effects. Good business governance inspires staff confidence such that when disaster strikes, the process of recovery is very short and there is reduction in losses. Additionally, good

⁴⁵³ Abu Dhabi & UAE, Ibid p. 22

⁴⁵⁴ Statement from Members Countries of the Commonwealth Consultative Group on Human Settlement at the Special Session On Habitat II, New York, June8, 2001.

⁴⁵⁵ D. A. McEntire., C. Fuller., C. W. Johnston and R. Weber. (2002), A Comparison of Disaster Paradigms: The Search for a Holistic Policy Guide, *Public Administration Review*, 62(3), 2002; pp. 267-281.

⁴⁵⁶ Ibid

business governance will inspire stronger and more thoughtful preparations for future disaster⁴⁵⁷.

The fourth phase is business-controlling capacity. In this case, Abu Dhabi businesses should be able to create job opportunities that work with social service providers such as housing for the homeless, care for the needy and handicapped and provisions for the disabled and unfortunate persons. If such structures exist in advance, UAE businesses are unlikely to suffer excessive losses when disasters strike⁴⁵⁸.

Collectively, each of these phases is important for the Abu Dhabi business preparedness for disaster whether natural or non-natural. In the Abu Dhabi, the man-made disasters tend to be the most commonly affecting business than the natural, which take a while. Some of the common non-natural disasters affecting businesses in the Abu Dhabi include chemical spillages at factories and work sites; building collapses especially those that are still under construction, chemical, gas and electrical explosions.

Others are food or water poisoning, industrial radiations, infrastructural accidents and terrorism. The Abu Dhabi businesses have had to battle with poor sanitation conditions in some businesses from their affluence and undesignated disposal practices. Such practices put the live of the surrounding communities at risk of disease outbreak including environmental pollution. Therefore, the role of the business leaders is to address all these health and safety issues before the cause disasters⁴⁵⁹.

When adopting a business sustainability and continuity model, it is imperative to outline the segment risks and their corrective action required, whether investors will be required to absorb or pass the same to the supply chain. In most cases, the disaster risks are passed to the insurance firms, however, the process can be very expensive for medium to large businesses. Moreover, if the insurance cost was big, the respective firms can take longer than expected to the detriment of the business. Moreover, in wide spread disasters, the insurance firms could be struggling with settling numerous claims and this factor could put particular business sustainability and continuity to questions. If a

⁴⁵⁷ Ibid

⁴⁵⁸ Ibid

⁴⁵⁹ A. Botterell, *The life Cycle of a disaster: A Field Guide for Journalists*, Michigan State University Publications, 2001.

business entity decides to absorb the costs of losses, it could mean winding up or closure and many dependents can be put to risk⁴⁶⁰.

9.3.6 The National Emergency Crisis and Disaster Management Authority (NCEMA)

In the UAE, the National Emergency Crisis and Disaster Management Authority (NCEMA) is responsible for enhancing relationship between direct and non-direct sustainable development⁴⁶¹. First, NCEMA is responsible for organizing conferences at national and international level to bring together industry experts and practitioners in different fields to discuss and implement agenda for disaster preparedness and management. NCEMA ensures that all players attending conferences have adequate knowledge about disasters and their mitigation factors.

NCEMA holds annual meetings where GCC member states discuss disaster and emergency problems and solutions and ways of preventing their recurrence in future. The annual meeting further deliberates on the key sectors and facilities that are prone to disaster with likelihood of endangering lives and property. These discussions focus on,

“Disaster resiliency, readiness of government and agencies, effective leadership, counter terrorism strategies, environmental, industrial, cyber security, crisis communications, media management, emergency public warnings, and telecommunications, protecting critical infrastructure, and the role of public health during emergencies.”⁴⁶²

NCEMA is involves in disaster program trainings of the key institutions in the UAE. Among the institutions targeted by NCEMA is educational, government, non-government an any other organization with sizeable number of people whose lack of safety could meet the threshold definition of term disaster.

NCEMA coordinates all volunteers wishing to participate in disaster rescue and recovery efforts as they work with the government agencies. Therefore, all people or non-government organizations which wish to participate in the disaster prevention and

⁴⁶⁰ Malmquist, Ibid.

⁴⁶¹ UAE Supreme National Security Council, *National Emergency Crisis and Disaster Management Authority*. p.35, Retrieved January 18, 2015, <http://www.ncema.gov.ae/content/documents/NCEMA%20JB%2034191%20English.pdf>

⁴⁶² UAE Supreme National Security Council, p. 37.

recovery volunteer services are required to register with NCEMA. For individuals, NCEMA requires them to be UAE and be adult or age with enthusiasm for national duty. Among the most active volunteer groups is the SANID, which has two levels of disaster response. At Level 1, the volunteers are expected to be able activate to after 36 hours of training on basic injury first aid, small fire fighting and other low cadre level of activities. After successful completion, the volunteers move to Level 2 training taking another 36 hours. In this level, the volunteers are prepared to handle sophisticated first aid, communication and evacuation of injured persons during disasters⁴⁶³. NCEMA attempts to fill the disaster information gap between the different institution and the public to improve their response and action plans⁴⁶⁴ as shown in the figure below:

Figure 45: Disaster Management Process in UAE



Source: Dhanhani, 2010, p.

⁴⁶³ UAE Supreme National Security Council, p. 41.

⁴⁶⁴ UAE Supreme National Security Council, p. 39-40.

9.3.7 The Convention on Long Range Trans boundary Air Pollution (CLTAP)

As far as air pollution disasters are concerned in UAE, GCC and within the MENA, various conventions have been in place to try to reverse and perhaps limit the risks. The Convention on Long Range Trans boundary Air Pollution (CLTAP) is one such arrangement that congregates scientists from these regions. The concern for CLTAP is to create awareness among the GCC member states that sulfur emissions from hydrocarbon powered machinery is a leading cause of acid rain which erodes environmental surfaces. However, when members of the CLTAP discovered that air, pollution could not be localized or regionalized; there was need for cooperation with other international bodies. The CLTAP was established in 1979 but ratified by MENA members in 1983. CLTAP is legally binding to the member nations⁴⁶⁵.

Within the UAE, there are smaller NGOs that are concerned about the man-made pollutions to the air. These NGOs task is to monitor and manage emissions from major industrial facilities. The NGOs offer guidelines for reducing air pollution, educate organizational members on the important and task leaders and decision makers with targets for compliance. The NGOs build capacity for reducing man-made air pollution and support regular monitoring process and support likeminded caucuses and conventions. Some NGOs act as quality assurance and certification bodies for industries that are seeking acceptance and recognition in international markets for their products. Other NGOs carry out regular audits to ensure concerned industries have internal capacity to reduce air pollution. The most challenging part has been the transport industry and the NGOs have been lamenting that big industry,

“Priorities for protection, building and implementing decision support systems, upgrading the role of NGO, and law enforcement of air quality conditions are still very low in the enforcement list.”⁴⁶⁶

9.4 The UAE Government’s Approach towards Disaster Management

Even though the UAE, GCC and other Middle East nations work hard to minimize these types of disasters, some events still occur, leading to loss of lives, property and

⁴⁶⁵ El-Raey, p. 6.

⁴⁶⁶ El-Raey, p. 6.

huge government or insurance resources in forms of compensation for the damages. The UAE government is particularly ever on alert to respond to the non-natural disasters using operational plans, laws and regulations⁴⁶⁷.

Rather than get involved in a reactive manner, the UAE government prefers a proactive awareness campaign and education of the public to avert most of the man-made disasters that dot the country and its territories occasionally. The UAE government has invested resources, machinery, personnel and inter-agency collaborations to manage any eventuality of man-made disasters. This public and private partnership has so far accomplished a lot and actually minimized many risks⁴⁶⁸.

9.5 Best Available Practices In the UAE Disaster Management System

The UAE has a robust Inter-Agency Standing Committee (IASC) who build consensus whenever key disasters caused by natural or non-natural issues arise with the need for humanitarian assistance. Such a scale of disaster is referred as “Level 3” and is accorded appropriate emergency activation also called “L3 Activation” so that all the affected masses can be served as such. The “L3 Activation” is only invoked in special cases where the situation is dire or degenerating fast. Therefore, the IASC Principals must certify all “L3 Emergencies” and responsibility shall be assigned to the Emergency Relief Coordinator (ERC) after the following conditions are met:

That the scale of area affected in terms of geographical area, population or property is significant for the “L3 Activation”.

That the timeliness for response is urgent because the residents are displaced, lives are lost due to scale of conflict and other sorts of humanitarian sufferings.

That the situation is complex and having different affects that call for many humanitarian actors or security specialists.

That the disaster capacity is requires intervention from the national or regional office, otherwise the situation could degenerate to fragile.

⁴⁶⁷ Al Kindi, M, *UAE gears up to tackle any potential disaster*, UAE Interact, Retrieved January 27, 2015, http://www.uaeinteract.com/docs/UAE_gears_up_to_tackle_any_potential_disaster/25446.htm

⁴⁶⁸ Ibid

That the disaster has a reputation of degenerating to negative media or mass attention if urgent humanitarian action is not forthcoming from donors, private and public organizations⁴⁶⁹.

The operations associated with the L3 are further clarified in manuals that are downloadable from the IASC website. For most humanitarian agencies, the huddle is how to judge which disaster to respond to and this process requires rapid feasibility study. Some of the issues that the organizations have to relate with include the scope and scale of disaster, the ability of the government to address the disaster and the possible effects. The initial role of the L3 Activation coordinators is to liaise with the government to ascertain scale or impact. Thereafter, the government or local organizations are expected to respond. Otherwise, the UAE is not a failed state where we would expect the international organizations to come in immediately during disasters. On certification of the L3 Activation needs, respective disaster organizations are informed and expected to swing into action. Disaster recovery and management organization has prerogative of not participating whenever the rapid risk assessment justified their lack of capacity⁴⁷⁰.

Whenever the international organizations are to be engaged in any UAE disaster response there must be justified needs. In most cases, the international agencies come to assist the local counterparts. Nevertheless, the international agencies are required to have some level of preparation in order to be effective in any disaster response processes:

- Cite the key humanitarian development issues that should trigger partnership and participation.
- Document the key issues with various disaster alert sources.
- Assess the organizations capacity to respond to the disaster depending on the impact to the population such as at least 10 lives lost, 50 injuries and more than 200 persons internally displaced.
- Have a telephone log for all the key personnel so that they can mobilize and activate within the shortest time whenever an emergency occurs. This contact list must include administrative, communication and operational staffs.

⁴⁶⁹ UAE- Ministry of International Cooperation and Development & OCHA, p. 2.

⁴⁷⁰ UAE- Ministry of International Cooperation and Development & OCHA, p.3.

- Ascertain that all key staffs are drilled in their roles in the disaster management and risk reduction process⁴⁷¹.

In the UAE and in resemblance with other nations, there are various phases of disaster response. First is the monitoring phase, whereby the respective agencies observe progress, measure impact and evaluate risks to prepare the most appropriate action. Second is the warning phase where the disaster agencies, following initial alert, are supposed to act, hence, some level of proactive readiness is always anticipated for problems like cyclones, floods, earthquakes among others. The third phase is alert and mobilization, defined by the duration between initial message of disaster and the first relief from the prepared teams. The fourth phase is operations, whereby the teams are supposed to be on the ground working on the disaster relief, saving lives and minimizing damage to property. The fifth phase is demobilizing, whereby the disaster organizations scale down their man-power and start to vacate the scenes or locations for the locals to rebuild lives and property according to the scale of impact. The final phase is the post relief phase, also referred to as the “Linking Relief to Rehabilitation and Development” (LRRD). At this stage, various assessment and reports may also be compiled to authorities to follow up on the entire exercise⁴⁷².

- The Disaster Monitoring System

In the UAE, there is a 24-hour disaster monitoring system as a guarantee that the alert and mobilization systems will be effective. Disaster monitoring is concentrated on general issues but be specific as soon as alerts arrive via phones or radio. It is the responsibility of the disaster organization to mobilize its staffs with speed as soon as alert is raised⁴⁷³.

There are various reasons why disaster monitoring is important. Initially, monitoring provides respective agencies with status at local, regional or national level. Monitoring enables disaster recovery staffs to evaluate the status rapidly. Monitoring prepares the respective organizations to act immediately and precisely. Monitoring enables the

⁴⁷¹ UAE- Ministry of International Cooperation and Development & OCHA, p. 4.

⁴⁷² UAE- Ministry of International Cooperation and Development & OCHA, p. 4.

⁴⁷³ UAE- Ministry of International Cooperation and Development & OCHA, p. 5

organizations to have in-depth information on the disaster likelihood. Monitoring connects the respective organizations to learn from past disasters and project to future vulnerabilities. Monitoring enables organizations to inform of others capacities⁴⁷⁴ and preparedness to deal with different disasters. Therefore, all above issues of monitoring will ensure the disaster management process is smooth across the board.

It is imperative for respective organizations to monitor disasters with robust data gathering of incidences then establish a profile, which is accessible by relevant persons. Such database must be reviewed at least bi-annual basis to ensure the information is useful to all. Monitoring should flag issues on urgency level to the management to prioritize action and resources. The monitoring teams also need to have regular meetings to discuss matter arising across the agencies. Various UN agency websites are used for monitoring disasters and disseminating information. These websites have pages classifying disasters on their urgency, locations and humanitarian situation⁴⁷⁵. Other ways of gathering data and information include faxes, telephone SMS and Calls. Among the key data monitored are weather conditions, seismic movements and sea water levels. There are specific weather websites that have monitoring information for national and regional status. These are complemented by other data sources such as military science reconnaissance and air traffic controllers' reports⁴⁷⁶.

- The Alerts

Once the monitoring personnel receive alerts, showing the possibility of key disasters or abrupt changes from norms, the relief services will be activated so that the affected persons or regions can start getting assistance. The role of alerts is multiple. Alerts enable the concerned persons to be aware of any emerging disaster, therefore, prepare them for action. Alerts provide the organizational or team leaders with information on which operations are forthcoming. Alerts create sense of organization so that no time is wasted as the relief teams move into action. Alerts trigger the organizations to make the first move in availing relief⁴⁷⁷.

⁴⁷⁴ UAE- Ministry of International Cooperation and Development & OCHA, p. 5

⁴⁷⁵ www.reliefweb.int, <http://humanitarianresponse.info>

⁴⁷⁶ UAE- Ministry of International Cooperation and Development & OCHA, p. 5

⁴⁷⁷ UAE- Ministry of International Cooperation and Development & OCHA, p. 5-6.

Various sources of alerts are useful to disaster organizations. These include e-mails, SMS, sirens and alarms as soon as the disaster occurs. Therefore, it is important for the team leaders to provide their contacts ahead of time to improve their reach during disasters. Other alerts often communicated via websites include volcano, earthquake, floods and insect invasions. The rest of alerts are via mainstream media of news websites. Response team leaders should sign up for automatic updates from these websites⁴⁷⁸. However, if the automatic updates are missing and likely to create information gaps, there is provision of scheming through various websites⁴⁷⁹ and gathering information.

The media has become a very formidable force for disseminating disaster and emergency alerts. Various media having international outreach include Reuters, CNN, BBC, Sky News Arabia, Al-Arabiya and Al-Jazeera News among others. These news outlets can cover disasters as breaking news or hourly briefs whereby the public and respective organizations can assess situations accordingly. Additionally, the media offer networks for discussing lives lost and damaged property including orders for evacuation for safety. However, all new sources⁴⁸⁰ often require confirmation and should not be the sole course for the disaster management organizations to swing to action.

- The mobilization

The next stage is mobilization of organizations to the site of disaster. There are different ways of mobilizing organizations to disaster focal point. However, the following is the standard way of proceeding:

- Gathering all the disaster information from the new or alert sources and corroborating them.
- Activating response organizations to participate in the process accordingly.
- Keeping contacts of the response electronically so that it can be circulated to all the partners.
- Mapping the disaster area and circulating copies to all partners.
- Documenting the earlier phases of the disaster including the organizations informed.

⁴⁷⁸ www.alertnet.org ; <http://earthquake.usgs.gov> ; www.irinnews.org/subscriptions ; www.gdacs.org

⁴⁷⁹ www.reliefweb.int ; www.hewsworld.org/hp ; www.gdacs.org/index.asp ; www.fews.net ; www.hrw.org ; www.arabstates.undp.org ; www.crisisgroup.org/home/index.cfm ; www.arabhum.net

⁴⁸⁰ <http://www.skynewsarabia.com> ; www.alarabiya.net/english ; <http://news.bbc.co.uk> ; <http://edition.cnn.com> ; www.irinnews.org/ME.asp

- Counter checking among the available contacts, which are locally, regional or internationally available.
- Acquiring additional data from government, NGOs, Commissions and all relevant sources⁴⁸¹.

- The deployment

During the deployment stage, there are various issues to confirm so that the best operation can be realized. This check is important as some disaster warrant international intervention and these could take slightly longer than the local or regional organizations to come to relief. Before the actual deployment, the staffs need some personal readiness including having appropriate dress code for the focal point, carrying the appropriate document referring to the disaster, equipment and material for rescue, recovery and rehabilitation processes, prior vaccination against yellow fever and group leader orientation. Additional information about vaccination is available in the World Health Organization website⁴⁸².

During deployment, there is need for the teams or organizations to have baseline data to enhance their operations at the focal point. Various websites are useful for accessing such information. Virtual Onsite Operations Coordination Centre (OSOCC)⁴⁸³, Relief Web⁴⁸⁴, Humanitarian Response Data Repository⁴⁸⁵, International Federation for Red Cross⁴⁸⁶, International Centre for Red Crescent⁴⁸⁷, together with other aggregate new websites. Other important information useful at deployment phase are the situation reports, Maps, Embassies, government, NGOs and country information. Moreover, the teams or organizations need a preliminary arrival and operations to follow. This is essential in case that are any changes in partnership, operations or relief⁴⁸⁸.

⁴⁸¹ UAE- Ministry of International Cooperation and Development & OCHA, p. 7.

⁴⁸² www.who.int/ith/en

⁴⁸³ <http://vosocc.unocha.org>

⁴⁸⁴ www.reliefweb.int

⁴⁸⁵ www.humanitarianresponse.info

⁴⁸⁶ www.ifrc.org

⁴⁸⁷ www.icrc.org

⁴⁸⁸ UAE- Ministry of International Cooperation and Development & OCHA, p. 9-10.

- Arrival and First Steps

Within 24 hours after the teams reach the disaster focal point, there must be capacity to confirm the situation on the ground and starting rescue, relief, recovery and reconstruction of the affected people and area. Therefore, all the operations must be precise and lean managed. If there is involvement of international organizations coming into the country for the first time, there is need for a brief meeting with the embassy staffs to familiarize on the situation once again⁴⁸⁹.

- Closing a Mission, Handover and Exit

Once the mission is completed, all the agencies require a systematic exit procedure, which is closely tied to the original plan of entry at the focal point. There should be consensus before teams or groups can exit a site of disaster. Therefore, the national organs need to coordinate the process and brief the rest of the groups of next action. Some of the issues that should indicate to an international agency time to exit include repetitive works, lack of need for extra time or urgency to complete tasks, normal rest and meal times, reduced emergency e-mail and disaster becoming predictable. Additionally, the exiting organization should empower the remaining ones to work on their own and be able to accomplish tasks, within the level of recourses at their disposal⁴⁹⁰.

The final stage to complete exit strategy is the handover from international agency to national, regional or local authorities. It is crucial to hand over the operation situation, assets and other resources so that teams responsible to measuring and evaluating the impact can be elaborate. Moreover, the partners should try to sign the handover documents to ensure everybody is on the same level of understanding. Even if there is deviation from the exit strategy that was compiled from the beginning, it is imperative to review and make it tenable for the handover authorities⁴⁹¹.

During handover, there could be some administrative issues that require additional sign-offs. These include extra bills, travel tickets, procurement receipts and other

⁴⁸⁹ UAE- Ministry of International Cooperation and Development & OCHA, p. 10.

⁴⁹⁰ UAE- Ministry of International Cooperation and Development & OCHA, p. 10.

⁴⁹¹ UAE- Ministry of International Cooperation and Development & OCHA, p. 11.

miscellaneous claims. Consequently, all duplicate or triplicate copies must be filed for future accounting and references. Finally, the disaster mission report should be compiled in time including activities, action persons and timeframe by the organizational head or team leader⁴⁹².

9.6 Use of Technology and Ideal Mechanism for Risk Reduction in Natural and Non-Natural Disasters

The UAE has published guidelines for assisting response during natural and non-natural disasters and risks. In this guideline, the public capacity to recognize the different types of disaster is relied upon for the subsequent intentions or actions to stay safe or keep off danger and perhaps minimize the negative impact. The main purpose of the guideline is to create awareness and preparedness for whichever events the public could face and which endanger their lives or property. The guideline has been published in the simplest manner that most people could interpret procedures, precautions and components on disaster management⁴⁹³.

- The UAE Disaster Emergency Contact Numbers

Specific natural disasters either have occurred in the UAE or have potential for causing damages to lives and property. These include lightening, floods, earthquakes and tremors, tsunamis, landslides, power outages among others. Whereas some of these disasters could be having prepared kits, it is doubtful that all members of the public could be having access to them; therefore, continuous communication is very essential⁴⁹⁴.

UAE has notified disaster emergency contact numbers of Police, Ambulance, Civil Defence and Installations and Coast Protection Agency for all the seven emirates. These numbers are east to remember three digit nation-wide emergency contact numbers which are manned round the clock. In addition, the contact numbers of National Seismology and Meteorology Centre located in Abu Dhabi city has also been notified. The following table shows a collection of emergency telephone numbers in UAE.

⁴⁹² UAE- Ministry of International Cooperation and Development & OCHA, p. 11.

⁴⁹³ UAE, *Your Guide for Emergencies*, The Supreme Council for National Security, National Emergency Crisis and Disaster Management Authority, 2014. Retrieved <http://www.ncema.gov.ae/content/documents/NCEMA%20Eng%20Daleel.pdf>

⁴⁹⁴ UAE, *Your Guide for Emergencies*, p. 7.

Figure 46: UAE Disaster Emergency Contact Numbers



Source: UAE, *Your Guide for Emergencies*, p. 24.

9.7 Identification, Analysis and Control Measures for Disaster Risks in Abu Dhabi

- Identification of Disaster Risks

Identification of disaster risk is a very important step in the disaster risk management program. Once the disaster potential is identified, the other steps in the disaster control hierarchy are considered. The UAE's geographical location around the Arabian Plate between the Iranian plateau and the Zagros Fault making it vulnerable to various natural disasters and the region's history of seismic movements was discussed in detail in the Chapter 2. The various disaster risks, both natural and man-made, the UAE is prone to has been identified in this chapter. In section 2.4, a brief account of natural disasters in GCC and UAE was covered with specific instances of natural disasters that have occurred in the UAE. Each disaster was discussed in detail including the year, location and impact to human beings and property.

- Analysis of Disaster Risks

Our methodology commenced with a rapid initial evaluation of the disaster preparedness and experiences in Abu Dhabi and UAE, including impacts. This preliminary assessment was useful for mapping the study areas, gauging the disaster effects on the people and identifying any relief needs. It is important to clarify that this report was not exclusively prompted by a major disaster outbreak in Abu Dhabi and UAE, rather, it was an overall status and update. Some of the key performance indicators that we looked out for include provision of medical services, availability of clean water and sanitation, emergency preparedness, food needs and availability, housing and shelter provisions⁴⁹⁵.

The rapid initial evaluation offered some insight on the Abu Dhabi situation, material needs, operational priorities and response. The risk assessment questions are shown in Appendix D. Moreover, the rapid initial evaluation enabled the researcher to do the following:

- Determine the past disaster impact on the Abu Dhabi communities and the infrastructure and how the people coped with the situation.
- Establish the social vulnerabilities and relief needs
- Evaluate the scale of response required by the affected people and the nation, whether internal, international or both to stabilize situation.
- Prioritize the relief needs and projected ways of delivering them to the affected.
- Collaborate with other partners by complementing each other's gaps.
- Mobilize political goodwill, cultural tolerance and overcome logistical challenges.
- Recommend to the national and regional disaster management authorities on relief priorities and resource needs.
- Point out problem areas in the disaster management process
- Map the areas and sub areas to ease relief dispatch operations⁴⁹⁶.

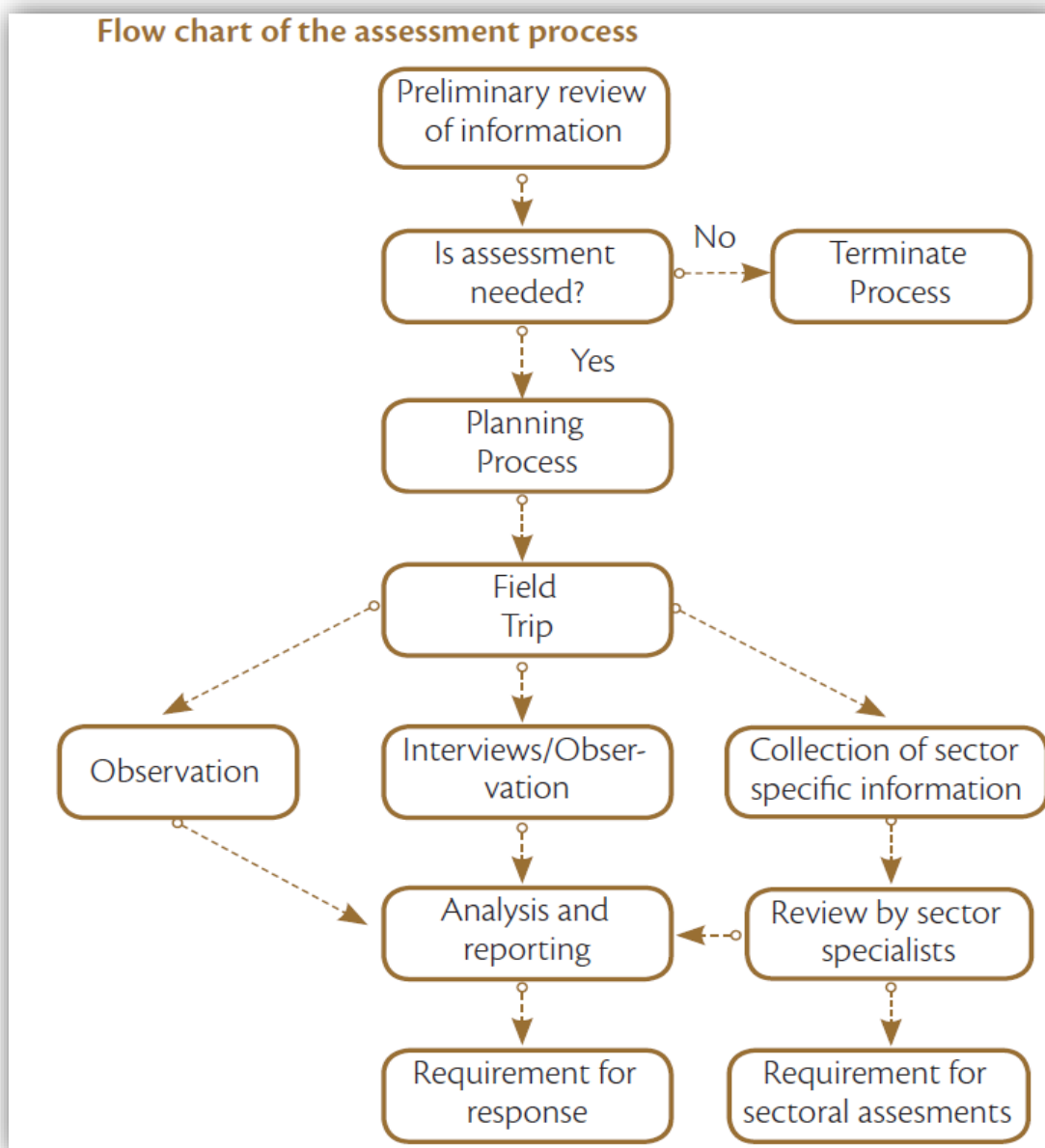
In the research procedure, we collaborated with local and national authorities to access various material and information. Some of the information includes organizational

⁴⁹⁵ UAE- Ministry of International Cooperation and Development & OCHA – United Nation Office for the Coordination of Humanitarian Affairs, p. 25.

⁴⁹⁶ Ibid.

structures, persons in charge of different activities and baseline data. Furthermore, we consulted UN agencies and Non-Governmental Organizations whose works within disaster management and risk reduction was relevant to this report. Other important sources of information were gathered from the UN Disaster Management Teams, National Disaster Management Coordinator and NGO heads. The researcher was acquainted with the terminologies applicable in disaster management including standards for situation indicators. The following figure illustrates the path adopted by the overall risk assessment of Abu Dhabi in the UAE.

Figure 47: Flow Chart of Abu Dhabi Risk Assessment, Gap Finding and Recommendations.



Source: UAE- Ministry of International Cooperation and Development & OCHA – United Nation Office for the Coordination of Humanitarian Affairs, 2015, p. 27.

- Control Measures for Disaster Risks

The Abu Dhabi disaster risk assessment was time based on the last decade's events that have caused loss of lives and destruction of property. Even though some situations could have improved since the occurrence of specific disaster events, this study timing

was to check the preparedness of institutions, population and government if problems were to recur. This study did not have any life threatening disaster as of the time of conduct; however, the report has potential of indication for the Abu Dhabi preparedness within 72 hours window of any event⁴⁹⁷.

The Abu Dhabi assessment observed authenticity of information since they have varied strengths and weaknesses. This was important to avoid generalization because the UAE does not have uniform geographical features for disaster vulnerability. Therefore, the researcher eliminated such biases. The researcher reached some rational assumptions because the research had given period for completion. Whenever there were language barriers, an interpreter was sought and this process was particularly helpful in understanding disaster issues from a cultural and local view. For example, some disasters are associated with taboos⁴⁹⁸. Nevertheless, the use of interpreter's aspect of confidentiality with the study was addressed by seeking their prior permission to the interviews. In the discussion of the findings, there was triangulation of the literature sources, interviews and the risk assessment report⁴⁹⁹.

⁴⁹⁷ Ibid

⁴⁹⁸ UAE- Ministry of International Cooperation and Development & OCHA – United Nation Office for the Coordination of Humanitarian Affairs, p. 27.

⁴⁹⁹ Ibid, p. 28.

CHAPTER 10: ABU DHABI CRITICAL AND NON-CRITICAL GOVERNMENTAL ESTABLISHMENT IN TERMS OF DISASTER MANAGEMENT

10.1 Introduction

In Chapter 9, the disaster administration, management system framework and the organizations are involved, in the regional context, were presented. In this chapter, organization structures, roles and responsibilities of various government agencies, civic authorities, police and civil defence that play an active part in disaster management are presented. In order for Abu Dhabi to succeed in disaster management, there are various critical and non-critical actors, contributing in personnel, finance, resources, and other ways.

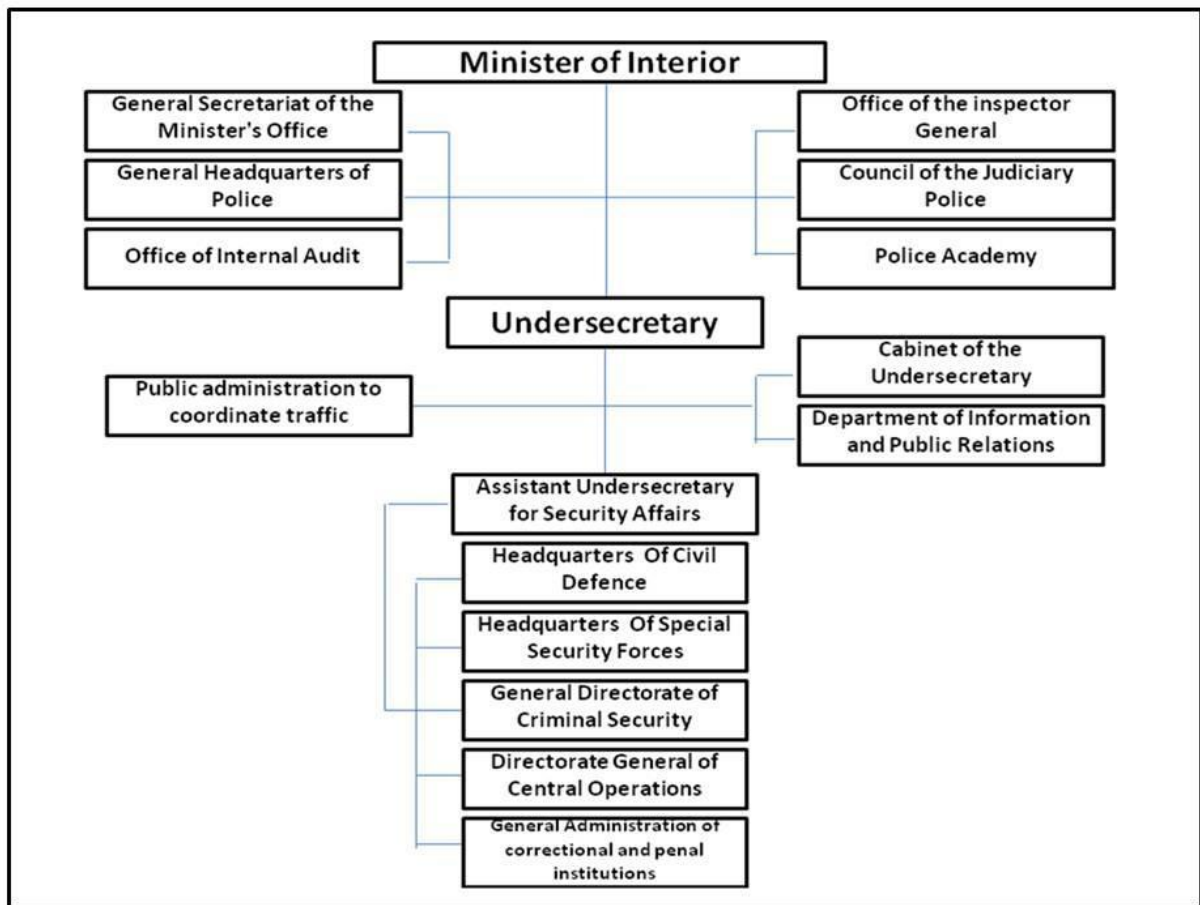
10.2 Abu Dhabi Critical Actors in Disaster Governance – Ministry of Interior, Ministry of Health, Ministry of Energy, Civil Defence and Police

- Ministry of Interior

The Ministry of Interior in UAE aspired to high legislative dispensation, technical capacity building, organizational coordination and systematic intervention during all forms of natural and non-natural disasters. The Ministry of Interior is always on alert for any possible disasters in the entire UAE and often deploys a standard procedure. Consequently, the Ministry of Interior has been able to mobilize its personnel and resources rapidly. In the last year alone, the organizational capacity of the Minister of Interior enabled the UAE to lower likelihood of disasters for every 100,000 heads to proportions better than other nations⁵⁰⁰. The following figure illustrates the organizational structures of the Ministry of Interior.

⁵⁰⁰ UAE Ministry of Interior, *Fire Safety Forum Kicks off on the Occasion of World Civil Defence Day*, Media Center, 2014,
<https://www.moi.gov.ae/en/media.center/news/fire.safety.technology.forum.kicks.off.on.the.occasion.of.world.civil.defense.day.aspx>

Figure 48: Organization Structure of the Ministry of Interior



Source: Dhanhani, 2010, p. 109.

- Ministry of Health

The Ministry of Health (MoH) in the UAE ensures that the country is safe from diseases, which have capacity of causing disaster. Therefore, the UAE was declared polio-free by year 2000 and subsequently malaria-free by 2007. Nevertheless, the MoH has been struggling with incidences of Tuberculosis and there is prevalence of about 2 persons for every 100,000. The prevalence of HIV is however low, whereas non-communicable diseases were responsible for nearly 67% of deaths in 2008. The MoH emphasizes healthy living among populations and a recent census established that more than 60% of the UAE populations are overweight. Another 20% have diabetes and 18%

could get diabetes if they do not change lifestyle. MoH reports that nearly 38% of deaths were caused by heart diseases⁵⁰¹.

The MoH has been focusing on the state of health of children and their mothers to support healthy living. The MoH in creating health and safety awareness among the public, uses massive resources and constructs facilities for the public to receive services. Nevertheless, the MoH has recorded high mortality rates due to the close relatives' marriages that cause genetic disorders. Most of these deaths happen during the earlier years after birth. Additionally, the MoH is concerned about other modes of death caused by tobacco use by children as low as 14 years old. In the past census, the persons under 14 years made up 39% of entire population and 82.1% by 2010. This trend worries the MoH and the Abu Dhabi government⁵⁰².

In the UAE, the MoH is concerned with the public health aspects and the Emirates Health Authority manages the health at Federal level. The UAE government offers free healthcare to all nationals while the foreigners are expected to subsidize their healthcare via various insurance schemes. In 2012, the UAE spent nearly US\$1,078 per capita. Due to the pressure for better and more healthcare services from the surging population and especially the older persons, this will rise by 15% by year 2020⁵⁰³.

By 2021, the UAE under the MoH has outlined a process of availing universal healthcare to entire population in terms of facilities and personnel to match the growing public demand. Additionally, the MoH has robust plans of standardizing the healthcare facilities to world class using strict governance and staff training. This is a follow up of UAEs ratification of the International health Regulations (IHR) established in 2007. The MoH is striving to harmonize the IHR to suit the UAE legislative frameworks, management, oversight, disaster preparedness, disease risk awareness, tests and standardization among other important public health safety concerns. The MoH has been trying to simplify the public health code and administration to address all aspects of disaster incidences⁵⁰⁴.

⁵⁰¹ WHO, *Country Cooperation Strategy*, United Arab Emirates, May 2014, p. 1 Retrieved, http://www.who.int/countryfocus/cooperation_strategy/ccsbrief_are_en.pdf

⁵⁰² WHO, *Country Cooperation Strategy*, p. 1.

⁵⁰³ Ibid.

⁵⁰⁴ WHO, *Country Cooperation Strategy*, p. 1.

In the recent years, the MoH has been deploying a primary health care program as a proactive method of tackling many types of disaster events. This strategy has faced some challenges because it heavily relies on expatriates who have extremely high turnover. The MoH expatriate staffs are 80% doctors while 90% are nurses and retention of these staffs should be priority⁵⁰⁵.

The following table is an illustration of the Ministry of Health Achievements in the UAE.

⁵⁰⁵ WHO, *Country Cooperation Strategy*, p. 1.

Table 31: Ministry of Health UAE Developmental Data

WHO region	Eastern Mediterranean
World Bank income group	High-income
CURRENT HEALTH INDICATORS	
Total population in thousands (2012)	9206
% Population under 15 (2012)	14.41
% Population over 60 (2012)	0.81
Life expectancy at birth (2012) Total, Male, Female	76 (Male) 78 (Female) 76 (Both sexes)
Neonatal mortality rate per 1000 live births (2012)	5 [4-7] (Both sexes)
Under-5 mortality rate per 1000 live births (2012)	8 [7-10] (Both sexes)
Maternal mortality ratio per 100 000 live births (2010)	12 [5-27]
% DPT3 Immunization coverage among 1-year olds (2012)	94
% Births attended by skilled health workers (2010)	100
Density of physicians per 1000 population (2007)	1.93
Density of nurses and midwives per 1000 population (2007)	4.09
Total expenditure on health as % of GDP (2011)	3.3
General government expenditure on health as % of total government expenditure (2011)	8.8
Private expenditure on health as % of total expenditure on health (2011)	25.6
Adult (15+) literacy rate (2005) Total	90
Population using improved drinking-water sources (%) (2011)	100 (Total) 100 (Urban) 100 (Rural)
Population using improved sanitation facilities (%) (2011)	95 (Rural) 98 (Urban) 98 (Total)
Poverty headcount ratio at \$1.25 a day (PPP) (% of population)	
Gender-related Development Index rank out of 148 countries (2012)	40
Human Development Index rank out of 186 countries (2012)	41

Source: Global Health Observatory, April 2014⁵⁰⁶.

⁵⁰⁶ Global Health Observatory, April 2014, Retrieved, <http://apps.who.int/gho/data/node.cco>

- Ministry of Energy

The Ministry of Energy has a very important role in the national economy. The Ministry of Energy therefore controls immense national resources that could fluctuate according to the oil prices. The Ministry of Energy contributes relief funds towards various disaster management processes. Thus, families that have lost their members and property destroyed are compensated accordingly. The Ministry of Energy also plays a very crucial role in the business recovery and reconstruction process after major disasters like floods, landslides, earthquakes, sandstorms, fires and others. Furthermore, the Ministry of Energy coordinates fuel rations to the public following major disasters. Finally, the Ministry of Energy accomplished studies on disasters, and how they affect national economic growth in terms of influencing oil demand, supply and prices⁵⁰⁷.

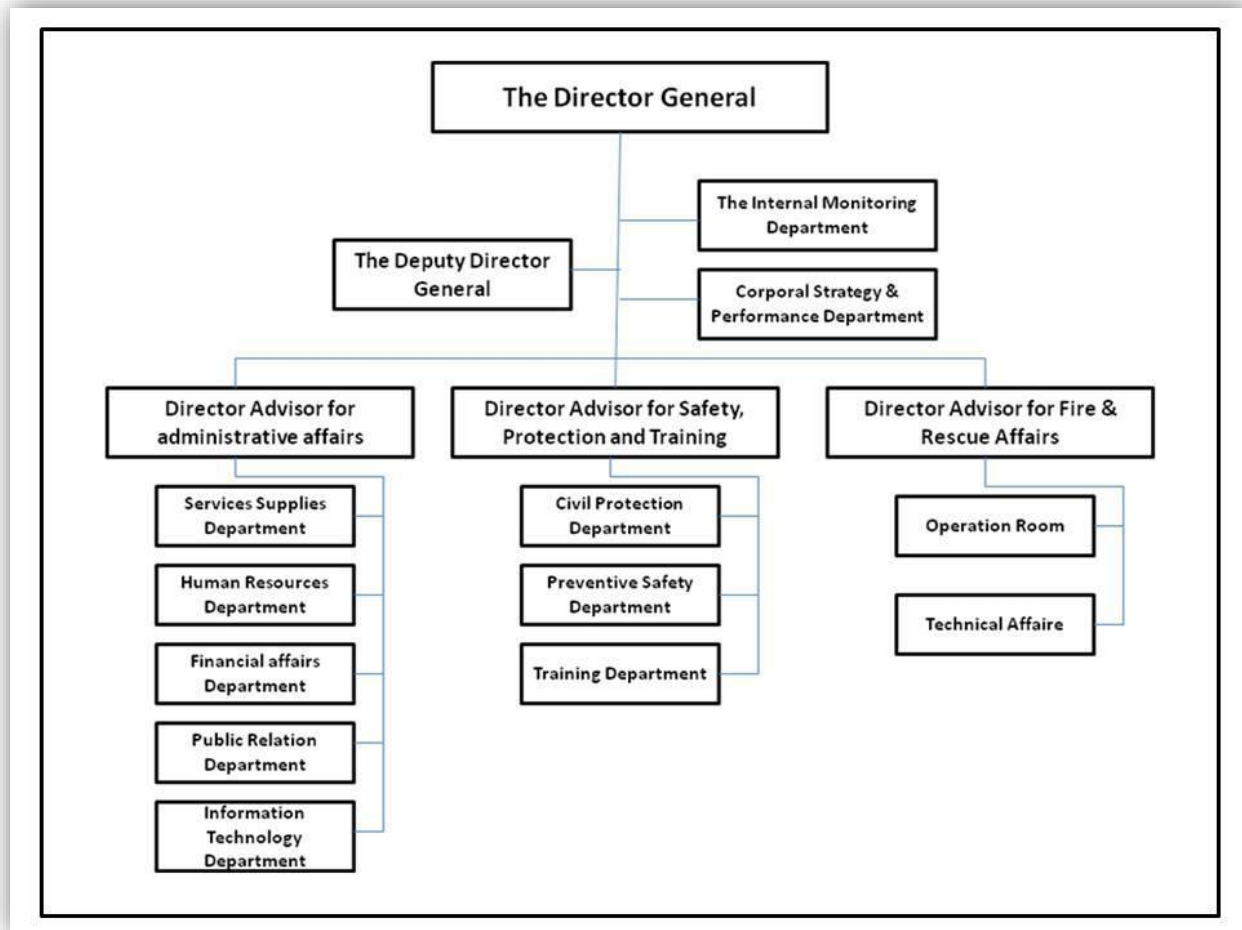
- Civil Defense

During disasters, the Civil Defense is engaged in several activities in Abu Dhabi. These include dissemination of information to the public about safety, eliminating issues that pose a threat to lives and property, training the public on simple steps like evacuation, firefighting, first aid among other skills. The Civil Defense also runs a database where the public and disaster management partners can share information on status. In previous disasters across the country, the Civil Defense has been very active in accounting for human lives as first priority, then property as second priority to expedite compensation. The Civil Defense tries to limit loss of welfare among families during disaster. The Civil Defense guards and protects the national assets during disasters and limits their depreciation as this can affect the entire economy. Finally, the Civil Defense is useful in bringing together families traumatized due to different types of disasters⁵⁰⁸. The following figure illustrates the organizational structure of the Civil Defense.

⁵⁰⁷ Khaili, K. A. & Patirage, C. *A Critical Review on Disaster Preparedness and Management of Emirati Energy Sector*. Issue 77, 2011; pp. 104-121.

⁵⁰⁸ Directorate of Civil Defense, *Civil Defense GHG Launches the biggest National Safety Campaign in Industrial Areas Throughout the Country*, Government of Abu Dhabi, 2012. Retrieved <http://www.dcd.gov.ae/view-news.php?news=2>

Figure 49: Organizational Structure of the Civil Defense



Source: Dhanhani, 2010, p. 113.

- Abu Dhabi Police

Abu Dhabi Police are at the center of informing the public about various disasters including leading investigations among those caused by non-natural causes to determine criminal responsibility. The Abu Dhabi Police have established an elaborate GIS mapping and positioning system to locate all structures and operations of economic importance. In most cases, Abu Dhabi Police uses intelligence to investigate and coordinate search, rescue and recovery efforts of persons and property after disasters. The Abu Dhabi Police adopts a GIS model harmonized from the best practice among developed nations. Other roles include “crime geo-analysis, public safety, protection,

police investigations, and crisis and disaster management, as well as other purposes, including mission-critical operations”⁵⁰⁹.

The importance of Abu Dhabi Police setting up the GIS center was to consolidate their operational data and be able to activate respective units promptly especially during emergency events. The GIS further enables the Abu Dhabi Police to share information with other disaster management partners by indicating the location or area, type of property affected, numbers of people affected among others. Abu Dhabi Police operates the GIS Command Structure (GISCS) with the following functions⁵¹⁰:

- Command and control system for high-priority crimes
- Automated vehicle location for monitoring crisis vehicles
- Closed-circuit TV cameras for viewing live feeds around the city
- Contingency and security plans for large-scale event and disaster planning
- Human resources system for viewing specialized personnel information for deployment.

The following table illustrates the National Disaster Response Plan.

⁵⁰⁹ ArcNews, *Abu Dhabi Police Creates GIS Center for Security: UAE Capital on the Road to a World Class Enterprise GIS*. Fall 2011, Retrieved, <http://www.esri.com/news/arcnews/fall11/articles/abu-Dhabi-police-creates-gis-center-for-security.html>

⁵¹⁰ ArcNews, Ibid.

Table 32: UAE National Disaster Response Plan

The Ministries and Key Stakeholders	Emergency Support Function (ESF)	Support Annexes & Incident Annexes
- President of the country. - Supreme Council. - Federal National Council. - Prime Minister. - Deputy Prime Minister. - Ministry of Defence. - Ministry of Finance and Industry. - Ministry of Interior. - Ministry of Governmental Sector Development. - Ministry of State for Cabinet Affairs. - Ministry of State for Foreign Affairs. - Ministry of Social Affairs. - Ministry of Education. - Ministry of State for FNC Affairs. - Ministry of Health. - Ministry of Foreign Affairs. - Ministry of Presidential Affairs. - Ministry of Higher Education and Scientific Research. - Ministry of Public Works. - Ministry of Justice. - Ministry for Financial and Industrial Affairs. - Ministry of Energy. - Ministry of Labour. - Ministry of Environment and Water. - Ministry of Culture, Youth and Community Development. - Ministry of Economy. - NCEMA	- Public Safety and Security. - Resource Support. - Urban Search and Rescue. - Communications. - Public Health and Medical Services. - Public Works and Engineering. - Energy. - Fire fighting - External Affairs. - Emergency Management. - Mass Care, Housing, and Human Services. - Transportation. - Total Quality Management. - National Strategic Planning and Preparedness. - Public Information. - Long-Term Community Recovery and Mitigation.	- Financial Management. - Science and Technology. - Special Populations. - Volunteer and Donations Management. - International Coordination. - Logistics Management and Support. - Private-Sector Coordination. - Public Affairs. - Worker Safety and Health. <u>Incident Annexes</u> - Biological Incident. - Oil and Hazardous Materials Incident. - Terrorism Incident Law Enforcement and Investigation. - Catastrophic Incident. - Cyber Incident. - Food and Agriculture Incident. - Nuclear/Radiological Incident.

Source: NCEMA, 2007.

Abu Dhabi Police favors their GIS system because of capacity to corroborate and confirm different sources of information during disasters. Moreover, the GIS is useful for recording the timeliness of the different response units and their effectiveness in dealing with the disaster at hand. Inter-agency team leaders and decision makers can later on meet to analyze the disaster management and make recommendations on how improvement can accomplish⁵¹¹.

10.3 Abu Dhabi's Less Critical Actors in Disaster Governance Such As Transport Authorities, Airport Etc.

The UAE has other actors during disaster management process. These include Ministry of Foreign Affairs, Transport, Defence, and Airport authorities and are coordinated by the IASC as the key Local Emergency Management Authority (LEMA). These authorities are engaged in assisting all the disaster management activities especially the coordination of different bodies. The importance of coordinating all these ministries and authorities is to increase government response and speed of disaster management. Moreover, the other disaster management actors are useful for mobilizing humanitarian relief and interacting with international stakeholders. During complicated disasters, these other actors are also useful for improving relief outreach where the main actors are unable to reach due to logistics or public hostilities such as opposition areas⁵¹².

10.4 Relationship between the Society, Culture and Disaster Response Teams during Crisis

There are various sequential relationship levels for responding to disasters and emergencies in the UAE. These include response in phases, progress monitoring, public alerts, resource mobilization and organizational deployment. Next is arrival of first teams and action, closing of rescue, recovery and reconstruction mission before handing to the local, regional or national government⁵¹³.

The UAE has different interpretations for the term emergency and its capacity to escalate to a disaster. Nevertheless, the UAE has different scales of disaster, starting from

⁵¹¹ ArcNews, Ibid.

⁵¹² UAE- Ministry of International Cooperation and Development & OCHA – United Nation Office for the Coordination of Humanitarian Affairs, p. 78

⁵¹³ Ibid, p.58.

small to catastrophic levels. The UAE therefore interprets all these according to deaths, injured and property losses. Most of the disasters, about 80%, in the UAE, are classified as small to medium scale. Therefore, the local and regional agencies are often enough to rescue, recover and stabilize situations. The international organizations could only be called upon when the relief needs are beyond the government's capacity to deliver⁵¹⁴.

⁵¹⁴ UAE- Ministry of International Cooperation and Development & OCHA, p. 2

PART 4: DISASTER MANAGEMENT EXPERIENCES IN ABU DHABI

CHAPTER 11: ANALYSIS OF RISK ASSESSMENT DATA ON NATURAL DISASTERS IN THE UAE

11.1 Data Collection and Analysis Methodology

A detailed account of the following five natural disasters that occurred during a twenty years period ranging from the year 1990 to 2010 was presented in Chapter 6.

- Al Qurayah Floods Disaster of 1995 (Friday, 11 December, 1995)
- Masafi Earthquake Disaster of 2002 (11 March, 2002 at 01:00 A. M.)
- Al Tawaian Landslide Disaster of 2005 (19 March, 2006)
- Tropical Gonu Storm Disaster of 2007 (4-5 June, 2007)
- Sharm Flood Disaster of 2009 (23 March, 2009)

The information gathered from the details of these disasters is documented in a tabular form below for quick review and further analysis. Salient features, namely, disaster event time and space co-ordinates; the consequences; the rescue agencies involved in the rescue activities and the lessons learned from these disasters have been extracted and presented in Table 1. The purpose of this documentation is to consider if any meaningful analysis of this data can be made to arrive at useful inferences, if any.

A risk analysis was considered suitable for the available data. The risk analysis will help in grading the disasters in consideration as low, medium or high risk disasters. This analysis will further help in determining the type of preparedness, response and recovery required for the various grades of risk and also shaping the disaster risk management policies at the local/regional/national level. This will also provide a risk management instrument for the local/regional/national disaster management authorities, the policy-makers, NGOs, the business community and other public or private stakeholders involved or interested in the management and reduction of disaster risks.

Table 33: Tabulation of Disaster Data
1: Al Qurayah Floods Disaster

<i>Disaster Event Time and Space Co-ordinates</i>	Human Impact (number of deaths OR number of severely injured OR permanently displaced people	Environmental and Economic Impact	Social/Political Impact	Rescue Agencies Involved
<i>Al Qurayah Floods Disaster of 1995 (Friday December 11, 1995)</i> <i>Location: Indian Ocean Coast (25° 14' 22N - 56°2138E), north of Fujairah City</i>	1. Town's food and drinking water supply was interrupted and the process of migration out of the town started 2. Thousands of livestock were swept along dead or injured. 3. Town's power lines were cut off	1. Caused the breakdown of the local dam 2. More than 90% of the Al Qurayah land mass was covered by the floods. 3. Over 90% of housing structures in Al Qurayah were damaged. 4. Farms, highways, houses, offices and other fixed and movable assets damaged 5. The UAE government offered US\$ 4 million for the reconstruction of the water dam and additional three flood breaks 6. The UAE government helped in reconstructing houses for the affected Al Qurayah populations	1. Lack of proper dam management and maintenance 2. Lack of systems to contain floods 3. Lack of warning systems 4. Lack of construction regulations 5. Lack of proper disaster mitigation procedures 5. Lack of national disaster management body to coordinate rescue efforts 6. lack of proper coordination, communication and equipment	1. Dubai Police 2. Fujairah Civil Defence 3. The Red Crescent

2: Masafi Earthquake

<i>Disaster Event Time and Space Co-ordinates</i>	Human Impact (number of deaths OR number of severely injured OR permanently displaced people	Environmental and Economic Impact	Social/Political Impact	Rescue Agencies Involved
<i>Masafi Earthquake Disaster of 2002 (March 11, 2002 at 01:00 A. M.)</i> <i>Location: Masafi is near the Hajar mountains of the UAE and on the road from Fujairah to Sharjah (25° 18 48 N, 56° 9 46 E)</i>	No one was injured	1. 230 structures including mosques, houses and hospitals had cracks 2. UAE Ministry of Public Works constructed about 85 houses within the Fujairah area as part of compensation	1. Delays in distributing tents to the needy people 2. Medical services were inadequate to cover the population 3. Lack of building and construction policy to cope with the frequent seismic earth movements in the Fujairah area	Civil Defence Ministry of Labour and Social Affairs, the Ministry of Housing and Public Works, the Ministry of Interior (Civil Defence) and the Ministry of Agriculture and Fisheries Red Crescent

3: Al Tawaian Landslide

Disaster Event Time and Space Co- ordinates	Human Impact (number of deaths OR number of severely injured OR permanently displaced people	Environmental and Economic Impact	Social/Political Impact	Rescue Agencies Involved
Al Tawaian Landslide Disaster of 2005 (March 19, 2006) Location: Al Tawaian – Dibba road connects with Emirate of Fujairah and is located at WGS84 and grid 416133E, 2825636N		1. Most of the road was blocked for half a year 2. MOPW used US \$45 million for the project.		local police Ministry of Public Works (MOPW)

4: Tropical Gonu

Disaster Event Time and Space Co-ordinates	Human Impact (number of deaths OR number of severely injured OR permanently displaced people	Environmental and Economic Impact	Social/Political Impact	Rescue Agencies Involved
<i>Tropical Gonu Storm Disaster of 2007 (4-5 June 2007)</i>	Government spokesperson clarified that only 50 bodies were retrieved, 27 reported missing and over 20,000 internally displaced	The entire Capital of Oman at Muscat was awash with the floods, weak buildings were collapsing, vehicles were overturned, trees fallen and the electrical and telephone supply disrupted for days Huge parts of the Emirate of Fujairah and sections of Sharjah were not spared by the events of the storm, whereby the winds reached about 160 mph (260 km/h) The MOPW estimated the damage from the Tropical Cyclone Gonu at \$600 million	1. The local medical facilities could not cope with the high numbers of injuries and traumatized residents 2. lack of clean water and electricity 3. rescued residents accused the UAE government for ineffective dissemination of the information about the impending storms 4. the food distribution networks and coordination were duplicated	Red Crescent Dibba and Fujairah Municipalities MOPW UAE Ministry of Education (MoE)

5: Sharm Flood

<i>Disaster Event Time and Space Co-ordinates</i>	<i>Human Impact (number of deaths OR number of severely injured OR permanently displaced people</i>	<i>Environmental and Economic Impact</i>	<i>Social/Political Impact</i>	<i>Rescue Agencies Involved</i>
<i>Sharm Flood Disaster of 2009 (23rd March 2009)</i> <i>Location: Sharm town is within the Emirate of Fujairah at 25o 28 7N – 56o 21 37E</i>		At least 30 residential buildings, 2 mosques, 10 agricultural lands and 10 vehicles were lost Most roads had water up to 1 m deep Over 50 households were completely devastated by the floods within the Sharm area with damage estimated running into tens of millions of dollars	a state of emergency was declared to enable the different agencies mobilize resources and work force towards relief the relevant authorities have not taken the smaller occurrences seriously as some errors such as need to maintain dams were very	Fujairah Civil Defence and Police Red Crescent Fujairah Defence Forces

Source: Ahmed Al Marzooqi, 2017

A literature review was carried out to find out earlier work carried out by researchers in this area and explore methodology, if any, is available for this analysis. While various methodologies for risk assessment of major industrial accidents are available in the literature, there are few methodologies developed for assessment of natural disaster risks. The International Organization for Standardization has brought out International Standards ISO 31010:2009 - Risk Management – Risk Assessment Techniques, and the corresponding ISO Guide 73 in this regard. This standard provides a methodology for risk analysis of industrial disasters. This methodology has been considered suitable and relevant by the European Commission in their Staff Working Paper on Risk Assessment and Mapping Guidelines for Disaster Management. Hence, it was decided to use this methodology for this analysis with slight modifications as necessary.

11.2 Definitions

It is necessary to define the terms used in this analysis. The associated ISO Guide 73 defines terminologies such as risk, risk assessment, risk analysis, risk criteria, consequences etc. as follows:

Risk is a combination of the consequences of an event (hazard) and the associated likelihood/probability of its occurrence. (ISO 31010)

Risk assessment is the overall process of risk identification, risk analysis, and risk evaluation. (ISO 31010)

Risk identification is the process of finding, recognizing and describing risks. (ISO 31010)

Risk analysis is the process to comprehend the nature of risk and to determine the level of risk. (ISO 31010)

Risk evaluation is the process of comparing the results of risk analysis with risk criteria to determine whether the risk and/or its magnitude is acceptable or tolerable. (ISO 31010)

Risk criteria are the terms of reference against which the significance of a risk is evaluated. (ISO 31010)

Consequences are the negative effects of a disaster expressed in terms of human impacts, economic and environmental impacts, and political/social impacts. (ISO 31010)

11.3 Data Validation

For proceeding with the analysis, it is necessary that the data gathered from the five disaster events are validated – to check if the so-called disaster events qualify to be called as disasters.

The WHO defines disaster as “any occurrence that causes damage, ecological disruption, loss of human life, deterioration of health and health services on a scale sufficient to warrant an extraordinary response from outside the affected community or area.” Consequently, by WHO standards, a disaster must be incapacitating and cause ecological disorder to a level where external assistance is warranted. Similarly, by WHO standards, a disaster normally has a geographical area affected at a specific time and hence its prevalence causes disruption of systems, structures and activities of social order to unanticipated proportions. Finally, by WHO standards⁵¹⁵, a disaster is characterized by

⁵¹⁵ World Health Organization, *Community emergency preparedness: a manual for managers and policy-makers*, Geneva. 1999.

events, which deviate from normal social order. Not all disaster emergencies cause loss of lives⁵¹⁶.

In 1990, a UN committee defined disaster as “a disruption of the human ecology that exceeds the capacity of the community to function normally”⁵¹⁷. Later, the UN’s Integrated Regional Information Networks provide a related definition of the term disaster as a “sudden, calamitous event that seriously disrupts the functioning of a community or society and causes human material, economic and environmental losses that exceed the community’s or society’s ability to cope using its own resources”. The same source attributes disasters to “hazards, vulnerability and inability to reduce the potential negative consequences of risk”⁵¹⁸.

According to the UN’s clarification, a disaster will be recorded in their database of International Strategy for Disaster Reduction (ISDR) if it meets at least one of the following guidelines that concur with the International Federation of Red Cross and Red Crescent Societies for oversight purposes⁵¹⁹:

- At least 10 persons die.
- At least 100 people lives are affected.
- When a nation or state declares a state of emergency.
- When there is call for international intervention.

ISO 31010 states that “Many risk events may have a range of outcomes with different associated probability. Usually, minor problems are more common than catastrophes. There is therefore a choice as to whether to rank the most common outcome or the most serious or some other combination. In many cases, it is appropriate to focus on the most serious credible outcomes as these pose the largest threat and are often of most concern. In some cases, it may be appropriate to rank both common problems and unlikely catastrophes as separate risks. It is important that the probability relevant to the selected consequences is used and not the probability of the event as a whole.”

⁵¹⁶ I. Shaluf, & F. Ahmadun, “Disaster types in Malaysia: an overview”, *Disaster Prevention and Management*, 15 (2), 2006, pp.286-298.

⁵¹⁷ Bertazzi, A. *Disasters and Major Accidents: Disasters, Natural and Technological*, Chapter 39, 1999. Retrieved January 21, 2015, <http://www.ilocis.org/documents/chpt39e.htm>

⁵¹⁸ Siriwardena, op cit., p. 252

⁵¹⁹ International Federation of Red Cross and Red Crescent Societies, *Disaster types*, 2006, Retrieved January 14, 2015, www.ifrc.org/what/disasters/types/

Applying the above criteria defined by these international bodies, to the disaster details provided in Table 1, it was validated that the all the five events described above meet with the definition of disasters, in so far as they meet with the criteria for at least one of the three impacts mentioned above.

11.4 Risk Assessment

Risk assessment is a process of determining the level of risk - magnitude of a risk or combination of risks, expressed in terms of the combination of consequences and their likelihood. According to ISO 31010, “risks are the combination of the consequences of an event or hazard and the associated likelihood of its occurrence. Based on the above definition of risk, disaster risk can be expressed mathematically as:

Disaster Risk = Disaster consequences (severity of impacts) x Probability of occurrence

- Probability

Probability or likelihood is the frequency with which the events have occurred. In risk management terminology, the word “likelihood” is used to refer to the chance of something happening, whether defined, measured or determined objectively or subjectively, qualitatively or quantitatively, and described using general terms or mathematically (such as a probability or a frequency over a given time period). We have considered a study period of 20 years ranging from 1990 to 2010 during which period the five events in consideration took place. The Al Qurayah Flood Disaster of 1995 and the Sharm Flood Disaster of 2009 were the two flood related disasters that took place during the study period, hence the frequency was taken as ‘2’ for flood disasters. The Masafi Earthquake Disaster of 2002 the Al Tawaian Landslide Disaster of 2005 and Tropical Gonu Storm Disaster of 2007 had occurred only once during this period. Hence, their individual frequency was taken as ‘1’.

- Consequences

Consequences are the negative effects of a disaster expressed in terms of human impacts, economic and environmental impacts, and political/social impacts”. These impacts are further explained in the following paragraphs:

Human impacts are defined as the quantitative measurement of the following factors: number of deaths, number of severely injured or ill people, and number of permanently displaced people.

Economic and environmental impacts are the sum of the costs of cure or healthcare, cost of immediate or longer-term emergency measures, costs of restoration of buildings, public transport systems and infrastructure, property, cultural heritage, etc., costs of environmental restoration and other environmental costs (or environmental damage), costs of disruption of economic activity, value of insurance pay-outs, indirect costs on the economy, indirect social costs, and other direct and indirect costs, as relevant.

Political/social impacts are usually rated on a semi-quantitative scale and may include categories such as public outrage and anxiety, encroachment of the territory, infringement of the international position, violation of the democratic system, and social psychological impact, impact on public order and safety, political implications, psychological implications, and damage to cultural assets, and other factors considered important which cannot be measured in single units, such as certain environmental damage.

- Risk Assessment Matrix

The Risk Assessment Matrix is a graphical representation of different risks in a two dimensional forms – severity on the x-axis and probability on the y-axis. The above cited European Commission guidelines on Risk Assessment and Mapping Guidelines for Disaster Management proposed a Risk Assessment Matrix with a five points scale for the severity and probability with the probability scale ranging from 1 to 5 depending on the frequency of occurrence of disaster events, and the severity of impact was measured in a qualitative scale ranging from 1 to 5, meaning 1- Limited, 2-Minor, 3-Moderate, 4-Serious and 5-Disastrous. This matrix proposed in the model below illustrates Risk severity and probability.

Figure 50: Risk Matrix

SEVERITY	1				VERY HIGH RISK	
	2					
	3			HIGH RISK		
	4	LOW RISK			MEDIUM RISK	
	5					
		PROBABILITY				
		1	2	3	4	5

However, this matrix was not considered suitable for the purpose of this analysis as the study period was limited to 20 years and the number of events was only five. Therefore, for the purpose of this analysis, the severity of the disaster effects was ranked into four categories only, namely 1-Minor, 2-Moderate, 3-Severe and 4-Disastrous. Similarly, the probability was also ranked into four categories as 1-Remote, 2-Occasional, 3-Frequent and 4-Rampant. Accordingly, the remodeled final matrix proposed for this study is given in the Figure below.

Figure 51: Disaster Risk Assessment Matrix

DISASTER RISK ASSESSMENT MATRIX					PROBABILITY			
SEVERITY		Impact on lives	Impact on Economy and Environment	Social/Political Impact	1 REMOTE : Occurred once in twenty years	2 OCCASIONAL: Occurred twice in ten years	3 FREQUENT : occurred once in a year	4 RAMPANT : Occurred more than once in a year
4	DISASTROUS	Loss of 10 or more human lives and/or massive disruption to life	Extensive damage	International impact			HIGH RISK	
3	SEVERE	Loss of less than 10 human lives and/or severe disruption to life	Major damage	National impact		MEDIUM RISK		
2	MODERATE	Loss of single human life and/or moderate disruption to life	Local damage	Regional impact				
1	MINOR	No loss of human lives but of cattle and/or minor disruption to life	Minor damage	Local impact		LOW RISK		
Study period: 20 years; Study area: United Arab Emirates								

Source: Ahmed Al Marzooqi 2017

The data from the Table 1 was applied on the matrix and the values of risk as the multiplication of probability and severity was ranked. The risk values are entered in the corresponding cell. As the floods disaster occurred twice in the study period, it was given twice the weightage i.e. it was considered in the column ‘Occurred twice in ten years’.

The assessments made for each event – floods, earthquake, landslide and storm is given in the following figures.

DISASTER RISK ASSESSMENT - Floods					PROBABILITY			
SEVERITY		Impact on lives	Impact on Economy and Environment	Social/Political Impact	1 REMOTE: Happened once in twenty years	2 OCCASIONAL: Happened once in ten years	3 FREQUENT: Happened once in a year	4 RAMPANT: Happened more than once in a year
4	DISASTROUS	Loss of 10 or more human lives and/or massive disruption to life	Extensive damage	International impact				
3	SEVERE	Loss of less than 10 human lives and/or severe disruption to life	Major damage	National impact		6		
2	MODERATE	Loss of single human life and/or moderate disruption to life	Local damage	Regional impact		4		
1	MINOR	No loss of human lives but of cattle and/or minor disruption to life	Minor damage	Local impact		2		
Study period: 20 years; Study area: United Arab Emirates								

Source: Ahmed Al Marzooqi 2017

Impact on lives = 6; Impact on Economy and Environment = 4; Social/Political Impact = 2; Total = 12 Medium Risk

DISASTER RISK ASSESSMENT - Earthquake					PROBABILITY			
SEVERITY		Impact on lives	Impact on Economy and Environment	Social/Political Impact	1 REMOTE: Happened once in twenty years	2 OCCASIONAL: Happened once in ten years	3 FREQUENT: Happened once in a year	4 RAMPANT: Happened more than once in a year
4	DISASTROUS	Loss of 10 or more human lives and/or massive disruption to life	Extensive damage	International impact				
3	SEVERE	Loss of less than 10 human lives and/or severe disruption to life	Major damage	National impact				
2	MODERATE	Loss of single human life and/or moderate disruption to life	Local damage	Regional impact	2,2			
1	MINOR	No loss of human lives but of cattle and/or minor disruption to life	Minor damage	Local impact	1			
Study period: 20 years; Study area: United Arab Emirates								

Source: Ahmed Al Marzooqi 2017

Impact on lives = 2; Impact on Economy and Environment = 2; Social/Political Impact = 1; Total = 5 (Low Risk)

DISASTER RISK ASSESSMENT - Landslide					PROBABILITY			
					1	2	3	4
SEVERITY		Impact on lives	Impact on Economy and Environment	Social/Political Impact	REMOTE: Happened once in twenty years	OCCASIONAL: Happened once in ten years	FREQUENT: Happened once in a year	RAMPANT: Happened more than once in a year
4	DISASTROUS	Loss of 10 or more human lives and/or massive disruption to life	Extensive damage	International impact				
3	SEVERE	Loss of less than 10 human lives and/or severe disruption to life	Major damage	National impact	3			
2	MODERATE	Loss of single human life and/or moderate disruption to life	Local damage	Regional impact	2			
1	MINOR	No loss of human lives but of cattle and/or minor disruption to life	Minor damage	Local impact	1			
Study period: 20 years; Study area: United Arab Emirates								

Source: Ahmed Al Marzooqi 2017

Impact on lives = 3; Impact on Economy and Environment = 2; Social/Political Impact = 1; Total = 6 (Low Risk)

DISASTER RISK ASSESSMENT - Storm					PROBABILITY			
SEVERITY		Impact on lives	Impact on Economy and Environment	Social/Political Impact	1 REMOTE: Happened once in twenty years	2 OCCASIONAL: Happened once in ten years	3 FREQUENT: Happened once in a year	4 RAMPANT: Happened more than once in a year
4	DISASTROUS	Loss of 10 or more human lives and/or massive disruption to life	Extensive damage	International impact	4,4,4			
3	SEVERE	Loss of less than 10 human lives and/or severe disruption to life	Major damage	National impact				
2	MODERATE	Loss of single human life and/or moderate disruption to life	Local damage	Regional impact				
1	MINOR	No loss of human lives but of cattle and/or minor disruption to life	Minor damage	Local impact				
Study period: 20 years; Study area: United Arab Emirates								

Source: Ahmed Al Marzooqi 2017

Impact on lives = 4; Impact on Economy and Environment = 4; Social/Political Impact = 4; Total = 12 (Medium Risk)

11.5 Findings

The findings from the analysis are listed below:

- Except for the Gonu Storm Disaster which resulted in a risk ranking “Medium risk”, all the other three disaster events – floods, earthquake and landslide - ranked “Low risk”.
- The data available is only for the period of 20 years. It is difficult to estimate the trend of disasters with this short. Further analysis for a much longer duration will be required to determine trends, predictability etc.

CHAPTER 12: INTERVIEWS WITH STAKEHOLDERS AND PARTICIPANTS OF THE UAE DISASTER MANAGEMENT SYSTEM

12.1 Introduction

In order to assess the existing mechanism for risk reduction during disasters, an interview was held with different stakeholders and participants of the UAE Disaster Management System, as a part of this study. An Interview questionnaire was prepared for this purpose and was administered to the stakeholders and participants such as National Disaster Management Coordinator, National Disaster Management Coordinator from the Civil Defense, National Disaster Management Coordinator in Ministry of Health, National Disaster Management Coordinator from Internal Ministry, Disaster Management Coordinator from United Nation Office of the Coordination of Humanitarian Affairs, Disaster Management Coordinator from the Inter Agency Standing Committee, UN Disaster Management Team Head from the International Committee of the Red Cross and others. The questionnaire consisted of the following eleven questions which included five questions on natural disasters and the rest on non-natural disasters:

- How are lightening disasters minimized or eliminated in Abu Dhabi and UEA in general?
- What risks are posed by floods and what are the mechanisms deployed to mitigate such disasters?
- What should the public do once they receive alerts and signals of earthquake or tremors?
- How should the public be on the lookout for Tsunamis?
- What signs of landslide should the public look out for to prepare for related disasters?
- What should the public do or not do during power outage disasters?
- What is expected of the public during wars?
- Which Chemical attacks should the public be on the lookout and what action should they take?
- What action should the public take during biological germ disasters?
- How can the public limit fire incidences and associated disasters?
- What action should respective authorities take during a radioactive leakage event?

The following are the findings from interviews of different stakeholders and participants in the Abu Dhabi and UAE disaster management and reduction process.

12.2 Questionnaire for Natural Disasters

Q1: How are lightening disasters minimized or eliminated in Abu Dhabi and UAE in general?

A: National Disaster Management Coordinator:

“In buildings, one of the tested and approved technologies of dealing with lightning disasters is to install arrestors on the roof. These will conduct the lightening charges and distribute them to the ground where their effects neutralize. Therefore, the lightning will not cause any damage to buildings or its inhabitants. Ordinarily, the regional government is supposed to map out areas that are prone to lightening from either research or experience. Therefore, such areas should have notices on safe sheltering and advice to the public not to carry around metallic material or stand under trees or bushes”.

A: National Disaster Management Coordinator from the Civil Defense

“Another step towards minimizing effects of lightning includes advising the public to wait until after the rains subside to take a shower. The reason is that the bathroom metal pipes can conduct lightning electric charges and cause harm. Moreover, some telephone lines have previously caused electric shock during lightning events, hence, the owners living in vulnerable areas should minimize such uses unless during emergency periods. Moreover, it is advisable to unplug electrical gadgets and turn off power as these have potential of conducting electrical charges from lightning with disastrous effects”.

The public staying in areas prone to lightning are advised to remain on lower or open areas because this minimizes the probability of lightning strike. Additionally, those in the seas or oceans are advised to come to the shores whenever possible. Other vulnerable activities like biking or public gathering should cease due to the probability of strikes or mass impacts. As soon as the public hear the sound of thunder, those using cell phone should cease with immediate effect. Moreover, those holding metallic surfaces, fences or gates should also stay away or risk lightning strikes⁵²⁰.

⁵²⁰ UAE, *Your Guide for Emergencies*, p. 9.

The next type of natural disaster with historical events is floods. Whereas some floods are caused by heavy rains, others are due to the local dam's inability to contain the huge volumes of water arising from the same, flowing over historically dry lands. Sections of the UAE has also experienced disastrous floods from cyclones and abrupt rise in the sea levels whenever there were heavy down pour in adjacent areas as witnessed during the Tsunamis. Sometimes, changes in the seabed water pressure can cause turbulence flooding on the surrounding lands⁵²¹.

Q2: What risks are posed by floods and what are the mechanisms deployed to mitigate such disasters?

- National Disaster Management Coordinator from the Civil Defense

“Some risk is posed by flood includes sweeping away buildings, movable property, farmland, drowning animals and man. Moreover, floods have potential of disrupting infrastructure such as telephone, electricity, roads, bridges, tunnels and other social amenities. Floods erode the most fertile layers of soil and the aftermath can lead to crop failure”.

- National Disaster Management Coordinator in Ministry of health

“In some places of the UAE, past floods were associated with disease breakout since the potable water was contaminated. Prolonged floods lead to famine especially where the population relies on agriculture as the main source of food and fields submerge.”

- Disaster Management Coordinator from United Nation Office of the Coordination of Humanitarian Affairs (OCHA)

“One mechanism that the UAE government is using to deal with floods is by providing the public with metrological reports of oncoming heavy rains. These advices arise from regular monitoring of the weather conditions and extrapolation of potential risks. Nevertheless, it is imperative for the public to take own precaution and ensure they can respond rapidly to any flood alarms and warnings from the authority. Failure to adhere to these emergency mechanisms causes the huge losses, damages and deaths experienced in most of the flooding events.”

During the flooding period, the public are advised to follow the government directives or any other information from the disaster rescue agencies without panicking. Often, the

⁵²¹ UAE, *Your Guide for Emergencies*, p. 10.

public will be required to contact the local or emergency authorities to notify them of their situation and this will be followed by advice on how rescue is organized. The emergency numbers to call are circulated to the public before or during the flooding events to activate any urgent evacuation needs. Moreover, the public must move to elevated sites to evade the floods. If there are any dams or waterways in the locality, the public should stay away urgently⁵²².

A: Disaster Management Coordinator from the Inter Agency Standing Committee (IASC)

“A common mistake by many people during flooding is to attempt to get into cars and drive away. However, this can be a disastrous move because the divers may not be away if the road beneath is still intact. Alternatively, the car could float and be washed away by the force of the floods and prove fatal to the occupants. The driving public are must respect security barrier orders to evacuate or avoid areas or risk their lives. Once a car starts floating due to floods, the occupants must get out and move to a raised area while on foot. Next, such affected persons must inform the local authorities, Civil Defense or disaster rescue agencies using the provided emergency numbers to trigger their rescue efforts”.

Earthquakes and tremors are the other causes of natural disasters in the UAE. Historically, earthquakes and tremors have proved a challenge to the people in UAE due to the abrupt events. Nevertheless, the relevant government agencies have devised ways of predicting their possible events and warning the public to stay safe and reduce property damages and loss of lives. However, latest technologies have been useful in detecting early signs. Earthquakes are caused by successive tremors, which trigger waves as the underlying rocks, and soil structures are re-arranged. Alternatively, earthquakes are triggered by volcanic activities that disturb the tectonic layers to new positions⁵²³.

In the UAE, most earthquake events often cause openings on the ground surface, disappearance of water springs and creation of new ones as the water table is re-arranges. In recent times, earthquakes have caused changes in the sea levels, leading to incidences of Tsunamis that causes destruction of transport and communication infrastructure,

⁵²² UAE, *Your Guide for Emergencies*, p. 11.

⁵²³ UAE, *Your Guide for Emergencies*, p. 12.

property and harmed livelihood. Normally, using technology, earthquakes are measured in magnitude from 1 – 10 on the Richter scales. Consequently, any earthquake of magnitude 1-4 is “small” and does not cause serious destruction to property or harm to populations. Earthquake measuring 4-6 magnitude are “medium” and have previously caused considerable damage to property and lives. Earthquake measuring 7-10 magnitude are very “powerful” and catastrophic in nature. Such occurrences have left cities or towns in utter destruction while people die in the rubbles⁵²⁴.

Most of the earthquake events in the UAE are ripple effects from the neighboring regions or countries like Iran. Such regional seismic shocks have very serious impact on the sea levels and buildings not constructed to desirable architectural specifications. The capacity of the UAE authorities to detect any potential seismic movements is beneficial to the public because they shall be informed on procedures of taking safety measures. The warning and information about earthquakes in the UAE come from the National Centre of Meteorology and Seismology. Thus, whenever an earthquake is detected miles away from the UAE, an alarm is sounded and all the emergency arms and agencies are activated to action immediately⁵²⁵.

Q3: What should the public do once they receive alerts and signals of earthquake or tremors from various technologies?

A: UN Disaster Management Team Head from the International Committee of the Red Cross (ICRC)

“As soon as the earthquake alarms go off, the public who are in buildings are expected to stand below doorframes or some strong covers to shelter from any possible debris falling and injuring them. The public must keep off windows, glass or other malleable surfaces as these can succumb to pressure of the crumbling or trembling building structures. Moreover, the public must be on the lookout for any potential gas leakages resulting from over stretched piping systems and if there is loss of electricity, lighting other fires to improve visibility is absolutely prohibited as these can cause fires”.

A: National Disaster Management Coordinator from Internal Ministry

⁵²⁴ UAE, *Your Guide for Emergencies*, p. 12.

⁵²⁵ UAE, *Your Guide for Emergencies*, p. 12

“For persons caught up in the earthquake or tremors while standing outside, there are specific guidelines to keep off trees and maintain open spaces as long as possible when the activities cease. Overhead or underground pass ways are not recommended during earthquake and tremors as can be affected by seismic movements and cause fatalities. Some buildings may not be safe because if the adjacent electric posts snap, they can cause shock to the occupants. People who are driving could be unable to sense earthquakes and tremors especially within rough terrains. However, as soon as the warnings are relayed over the radio, they must stop away from bridges and tunnels but must not come out of the vehicles. Thereafter, the public must be calm and await further information from national radios and television stations. Only those who are in dire stress should dial 999, otherwise mass calling will cause a jam of the network and communication failure”.

A: National Disaster Management Coordinator from Inter Agency Standing Committee (IASC)

“As soon as the earthquake and tremors subsides the search, rescue and recovery efforts need to commence. All reports of injured and missing persons are followed up for assistance under the leadership of Civil Defense working in collaboration with other agencies. A mini census of the people in the affected location follows to account for all and determine the extent of economic damage they have experienced. The surviving population must move around safely in full awareness that some glasses were shattered and could cause harm to their bare feet. Moreover, the surviving population should only turn on gas and electricity after the respective service providing agencies have ascertained safety. Otherwise, any dangerous electric conductions or gas leakages should be repaired before people can continue using facilities. The structural stability and safety of buildings has to be inspected by the local authority such as the Municipality Department or the Building Inspectorate Department”.

If residents must evacuate from a high-rise building during earthquake and tremors, then the lifts or elevators are no go zones since these could be having mechanical or electrical malfunctions. Similarly, people leaving residential houses must turn off all electrical power points, water, and gas and have an assembly point where all the head

counts is done. It is important for house owners and residents to insure their houses from general disasters including earthquakes and tremors⁵²⁶.

Persons who are trapped in the wreckages from collapsed houses during earthquake should try to signal to the rescue personnel either with a cloth or by waving. It is not advisable to light matches as these could ignite other fires from gas or flammable materials. Alternatively, whistling or shouting for attention is recommended to alert the rescuers on the exact location of the victims. The UAE disaster teams have compiled a rescue kit that includes a first aid box, manual, a pocket radio, a portable battery lamp, fire extinguisher, gas leak detectors and tools for repair of leakages, ladders and emergency numbers to reach respective rescue agencies⁵²⁷.

For persons trapped under building rubbles, the UAE has outlined additional mechanism to improve their survival rates. During the evacuation, the persons must cover their heads and faces with a strong surface from harm of falling objects or shattered glass. All persons must evacuate to a safe area where there is less likelihood of injury to all body parts including their feet. The persons should evacuate to a place with good air circulation and adequate light as much as possible. The elevators and staircases are considered unsafe because the earthquakes or tremors could have shaken their structural strengths. There is need to calm down and have drinks to prevent dehydration of the survivors⁵²⁸.

Tsunamis are another category of natural disasters that have tested the preparedness and resolve of the UAE government and its collaborative agencies. Generally, a Tsunami is caused by powerful water waves in the ocean or seas and has potential of rising nearly 30 meters, moving at 800 kmph. Consequently, Tsunamis often leave a wave of destruction especially for people and property along the shorelines. Whereas most Tsunamis are generated from the seabed earth movements or floods, the usual sea waves are caused by the winds⁵²⁹.

Tsunamis are very common around the Pacific Ocean because nearly 50% of the global volcanic events are experienced in this region. Most of the Tsunami events often

⁵²⁶ UAE, *Your Guide for Emergencies*, p. 14.

⁵²⁷ UAE, *Your Guide for Emergencies*, p. 15.

⁵²⁸ UAE, *Your Guide for Emergencies*, p. 16.

⁵²⁹ UAE, *Your Guide for Emergencies*, p. 17.

get the people residing, working or holidaying along the coast unawares. Areas with underground nuclear explosion are also known to cause Tsunamis if they are adjacent to oceans or seaways. The Tsunami impact at the bottom of the sea could be mild, but more destructive towards the top. Even though geologists, oceanographers, and seismologists can be having knowledge of the exact origin of earthquakes that predispose the Tsunami events, the latter cannot be stopped. Tsunami direction of activities is even more difficult to determine. Instead, the public needs timely warnings of the likelihood of Tsunamis so that they can take precautionary measures and minimize impacts⁵³⁰.

Q4: How should the public be on the lookout for Tsunamis?

A: UN Disaster Management Team Head from International Federation of the Red Cross and Red Crescent Society (IFRC)

“Even though the UAE is fairly shielded from the path of Tsunamis, there is however, a set of guidelines to handle such events, under the oversight of the National Centre of Meteorology and Seismology. Some of the early warnings that the public are advised to look out for include withdrawal from the shorelines. Thus, whenever people at the shorelines experience any sort of earth tremors or vigorous movements, it is advisable that they move to raised up places because the return on the waves could turn out to be a Tsunami. Such withdrawn sea lines do not require additional warnings about the oncoming waves and can occur for a distance of more than a kilometer. Moreover, the public must always move away from the shorelines that are showing signs of Tsunami because some waves can hit more than once. Thereafter, all the evacuation mechanism must follow to the letter”.

All persons caught unawares by Tsunami events must evacuate to safer areas according to the UAE guidelines. Any buildings around the shorelines likely to be affected by the Tsunamis must also be evacuated immediately once the signs or a warning has been communicated to the public. However, disabled persons who may not be able to evacuate with speed should be assisted up elevated housing facilities so that they can await specialized rescue operations in due course. For persons who are in ships or other water vessels, it is advisable to sail towards the shorelines because the deep seas can be trouble spots. If the waves persist, it is advisable for the sailors to leave the vessel

⁵³⁰ UAE, *Your Guide for Emergencies*, p. 18.

and move to a safer place off shore. All people around the shorelines must henceforth wait for the communication that terminates the emergency period before getting back to the usual shore or coastlines. This advice is informed by the nature of Tsunamis made up of numerous smaller, medium and big waves⁵³¹.

The UAE has had various incidences of landslides. Generally, a landslide is caused by shifting landmasses, which carry along earth, rocks, twigs, debris and other loose, or semi compacted materials. Whereas some landslides occur from the steep sides of hills and mountains, others are experienced at the basins and plateaus. Normally, the translational and the downward kinds of landslide are the most prominent across the world and the GCC⁵³².

It is not obvious that the land surfaces must be soggy or wet for a landslide to occur. Other factors can predispose landslide conditions. First, strong force of gravity acting on unstable leaning huge rocks can cause landslides. Second, steep slopes because of human such as road or railway construction and excavation of material can succumb to gravitational forces and cause serious landslides. Third, persistent rains soaking down layers of earth or the thawing action of snow can create crevices which in response to gravity lead to landslides. Fourth, the construction of dam walls along rivers or valleys can latter lead to landslides when the rivers burst their banks. Finally, the extraction of earth or rock during construction of tunnels and bridges causes disturbances on the strata this too could lead to landslides and disasters⁵³³.

Q5: What signs of landslide should the public lookout to prepare for related disasters?

A: National Disaster Management Coordinator from Field Coordinating Support

“The UAE emergency units advise the public to lookout for cracks in their roads, pillars, walls and valleys. Other obvious signs of impending or ongoing landslides include leaning of big trees, power and communication poles. Moreover, if the river course or water settlements shape changes, the residents should be aware that the area is prone to landslides. Rapid erosion of land surfaces by angular drainage is further indication of landslide in an area. When substratum earth layers suddenly expose to the surface, this could indicate presence of landslides. Therefore, upon noticing of each or

⁵³¹ UAE, *Your Guide for Emergencies*, p. 20.

⁵³² UAE, *Your Guide for Emergencies*, p. 21.

⁵³³ Ibid.

several of the above signs, the residents should alert the relevant government agencies to do a professional assessment and alert the public of possible problems.”

There are specific guidelines from the UAE government on course of action following the events of landslide. First, once the public notices any obvious signs such as movement of rubbles, they must evacuate the vicinity as soon as possible while carrying their emergency kits whenever available. Second, the public must be calm and lookout for emergency communications from the rescue teams via the mass media. Third, those inside residential areas must turn off utilities as these could escalate the disasters. Fourth, all communities must keep each other informed and safe. Drivers must be on the lookout for diversions especially when the landslides affect roads and railways. Any trapped motorist or residents must dial 999 for additional rescue⁵³⁴.

A: NGO Head from NGO Coordinating Council

“In the period after the landslide disaster, the public is advised to keep of the location and avoid turning on utilities until when declared safe by the local authorities and Civil Defence. The local police must register any injured, missing persons or damaged property in case the insurance are to be involved. Moreover, any buildings that have cracks and tilts must be inspected and ascertain their occupational safety by the municipal authorities. The public must only react to official information from the respective government rescue teams and agencies because rumors are not useful in disseminating information. Therefore, the public will always acquire information from radio or television on the next steps”.

Generally, the UAE advices families and individuals to stock up food and water enough for about two weeks in case some disaster strikes and limits public mobility to retail stores or markets. If the family cannot stock up, the emergency teams could provide the supplies. This advice arises because most disasters occur unnoticed and the magnitude or effects are unpredictable. The family has the discretion of determining the size of the supplies to stock up. The UAE also ensures that the water distribution is uninterrupted during disaster emergencies, because this could lead to breakout of diseases. Therefore, the Civil Defence normally distributes water to residents via rationing to ensure most people have access. Water tankers are taken to the public

⁵³⁴ UAE, *Your Guide for Emergencies*, p. 21-22.

residential areas where people congregate with containers⁵³⁵. There are general guidelines of food that can last for a fortnight⁵³⁶ as follows:

Whenever the UAE government undertakes to distribute food rations, the public is expected to follow the following procedures⁵³⁷. First, the public are required to register with the nearest government agencies the number of people in their families and each shall be issued a special identification code. Second, the families or individuals will be issues with a ration card that is accompanied by the family members' copies of birth certificates. Third, the government centers register the entire family member on the card after confirming their details. Finally, the head of family presents the food ration card to get the food provisions.

The UAE government has provisions for gas or fuel rationing during disaster emergencies to ensure fair distribution of limited supplies. This is coordinated by the Ministry of Power and Oil. The following is the procedure for accessing gas rations. First, the person is expected to register with the nearest government agency and shall be issue with a notification card. Second, the person is expected to present the card to civil registrar at designated places. Third, the person will be issues with gas card coupons. Finally, the person can present the gas cards at designated filling stations to meet their needs⁵³⁸.

During disasters in the UAE, the government has contingency measures for the public to donate blood. Normally, the government will put up an appeal for blood donations. Next the willing blood donors move to the designated centers and register with the medical personnel. The blood donor is expected to carry along their identification cards to enable the staff record details and assist in any complications⁵³⁹.

The UAE government has an elaborate public warning system during disaster and emergencies. There are various sirens that alert people of danger and are operated by the National Emergency Crisis and Disaster Management Authority while other are by the

⁵³⁵ UAE, *Your Guide for Emergencies*, p. 28.

⁵³⁶ UAE, *Your Guide for Emergencies*, p. 24.

⁵³⁷ UAE, *Your Guide for Emergencies*, p. 27.

⁵³⁸ UAE, *Your Guide for Emergencies*, p. 28.

⁵³⁹ Ibid.

Civil Defense. As soon as the public hear the sirens, they are supposed to stay safe and await further information from radio or other forms of mass media about the state of emergency and appropriate course of action⁵⁴⁰.

During disasters, public or families need various types of shelters. Ordinarily, these shelters are provided by the Civil Defense, with the objective of keeping people safe from harm's way during natural and non-natural disasters. First, there are home shelters that are close to the where the people used to live. Second, there are floor shelters, often wider than the home floors but still closer to the old home. Third, there are staircase shelters, whereby the public is encouraged to improvise space below staircases for living. Fourth, there are public shelters, often constructed near or within public amenities like schools, colleges, playing field and parking among others⁵⁴¹. The following table is an interpretation of the public warning systems.

Table 34: Public Warning Mechanism and Technology

Public Warning System		
Signals	Situation	Meaning
"Warning"	Sent in case of danger at national level, announced by the competent authorities	Move to the shelter immediately or to the previously selected area
"Out of danger"	Sent when the threat abates	Could go home
"Important announcement"	Sent to inform people to listen to the media for an important announcement	Listen to any local radio immediately or any other means available

Source: UAE, *Your Guide for Emergencies*, p. 30.

Whenever the public hear the emergency warning signs, they are expected to move into nearby shelters, whether housing facility or underground bankers for such scenario purposes⁵⁴². Moreover, the public is advised to keep of windows as glasses could shatter on their faces. Any person who is unable to locate a nearby shelter is advised to squeeze into water drainage systems or trenches by avoid electrical holes as these could cause

⁵⁴⁰ UAE, *Your Guide for Emergencies*, p. 30.

⁵⁴¹ UAE, *Your Guide for Emergencies*, p. 31.

⁵⁴² UAE, *Your Guide for Emergencies*, p. 34.

electrocution. The UAE normally publishes the location of public shelters on their website for further information.

As the people access the public shelters, the process should be orderly and in abeyance of staffs giving instructions. As much as possible the entire family should move into the public shelter so that the elderly and special needs can be served accordingly. Motorists must stop upon hearing emergency warning sirens and get of their vehicles to the adjacent public shelters. Some pedestrian tunnels are also useful whenever the person cannot locate a public shelter. Excess baggage should not be brought to the public shelters because they occupy space in the public shelter. Vacating the public shelter should only be after authorities order so and the entire family must move together for purposes of head count or accountability⁵⁴³.

12.3 Questionnaire for Non-Natural Disasters

Among the most common non-natural disasters are electrical power outages. Typically, the power outages can be short or long lives depending on their causes. Additionally, the power outages can affect sections or entire areas. In the UAE, the few power outages that occur are due to abrupt breakdown in the national grids, destruction of the power lines or stations, illegal power connections, power surges and other numerous forms of human mistakes whether intentional or otherwise. Nevertheless, the UAE is always on the alert about the power outages and the eventualities such as economic slowdown, damage to electrical equipment and gadgets and occasionally electrocution of animals or humans. Consequently, there are specific contingency measures that the UAE advises the public or organizations to follow⁵⁴⁴.

Q6: What should the public do or not do during power outage disasters?

A: National Disaster Management Coordinator from Ministry of Power and Oil

“The response to emergency response involves use of provided kit, which has a torch and radio. The person is expected to listen to the radio for any updates from the relevant authorities. Generally, the radio is one of the most effective ways of communicating with the public. Additionally, the people news the possible cause of power outage or accident are expected to raise the relevant agency, whether Civil Defense or the Municipality to

⁵⁴³ UAE, *Your Guide for Emergencies*, p. 34

⁵⁴⁴ UAE, *Your Guide for Emergencies*, p. 23.

come and repair the faulty sections or facilities. The public must avoid temptation of rescuing anybody who could have been electrocuted by power faults because they too risk the same fate. Anybody stuck inside the elevators during power outages should stay put until when the emergency teams arrive to their rescue”.

The responsible companies or agencies that provide the services also notice most power outages. Therefore, the public is advised to limit calls to the Civil Defense because the communication systems could be jammed with mass calls. Motorists must also be cautious especially where power lines are involved and the grounds are wet with risk of electrocution. Thus, it is important for the motorist to maintain their headlights during the power outage to increase their visibility⁵⁴⁵.

The next category of non-natural disaster causes are wars, which result into injuries, deaths, destruction of property, hardship and slowdown in economic growth. Whereas some countries or its regions are always seeking peace among people, some wars are justified on a defensive purpose. Generally, war is the last solution and should not be rushed before all avenues of dialogue are explored. Within the Middle East, some international wars often spill over to the peaceful neighbors and cause disaster in terms of the refugee situation. Other emergencies precipitated by war include disruption of flow of essential humanitarian commodities, food, water and other utilities. The risk associated with wars is that some are known to the public well in advance while others are abrupt. Therefore, the public is not prepared for the consequences of war in many cases⁵⁴⁶.

Q7: What is expected of the public during wars?

A: National Disaster Management Coordinator from Urban Search and Rescue team

“During wars, the public is expected to use provided shelters and inhabit them for safety. The public should stay put until when communication is forthcoming from relevant authorities. It is advisable to improvise shelter material from the household goods as long as the family members are safe from harm. However, when the alarm or warnings are sounded after a person has left the house; it is advisable to get into any nearest building or tunnels until when conditions are clear”.

⁵⁴⁵ Ibid.

⁵⁴⁶ UAE, *Your Guide for Emergencies*, p. 26.

Irrespective on type of warfare, the surrounding air will be polluted with ammunition gases. Therefore, the UAE guidelines on how households are supposed to operate air vents are elaborate. Initially, all house construction must have air vents, which are sealable with steel boards to prevent contaminated air from diffusing into houses and harming inhabitants. As long as fresh air is encased in the building, the occupants are safe for some time but this will depend on the number of people inside. However, it is advisable to open the air vents by 25% if the indoor stay is prolonged and likely to cause suffocation. These air vents can seal using steel covers and special types are donated by the Civil Defence on request⁵⁴⁷.

Acts of sabotage are another category of non-natural disaster causing factors. Broadly, sabotage can be from chemical, biological, bombing, poisoning, radiation or other modes of deliberate or accidental factors. In the UAE, similar to other areas of the world today, terrorism is a major concern as extremists have been targeting densely populated facilities or work places. These hostile activities tend to cause injury, loss of lives, destruction or property and halt operations temporarily or permanently. Moreover, the objective of most terrorists is to cause fear among the public. In the current decades, the terrorists have become very sophisticated because some are using covert tactics to get the public by surprise. These terrorists are further exploring chemical, biological, electrical and radioactive materials to target the populations. Therefore, the UAE government has various mechanism of dealing with each situation as it occurs⁵⁴⁸.

Q8: Which Chemical attacks should the public be on the lookout and what action should they take?

A: UN Disaster Management Team Head

“Among the chemical agents that have previously been used for targeting and harming public include Sarin gas, Sulphur Mustard, Hydrogen Cyanide and Phosphates. Most of these chemical affect a human being nervous system after being inhaled. The UAE has provided guidelines for identification of each of these dangerous gases to assist the emergency rescue staffs speed up their actions and save maximum lives. There are general guidelines for identifying chemical attacks. These include irritation to the eyes,

⁵⁴⁷ UAE, *Your Guide for Emergencies*, p. 33.

⁵⁴⁸ UAE, *Your Guide for Emergencies*, p. 40.

loss of breath, migrant headaches and nausea. Additionally, there can be instant loss of lives or chemical residue in animals or human tissues during postmortem”.

A: NGO Head from Inter Agency Rapid Response Team

“...the persons exposed to chemical attacks must change clothing and take a shower to minimize poisoning effects and contamination of others. It may not be advisable to give first aid to a person who has chemical attack unless with good knowledge and information of what needs to be done⁵⁴⁹. Otherwise, new contaminations could take place. It is advisable to keep the contaminated cloths in a bag and dump them at designated areas”.

The UAE has provided guidelines on how people need to react whenever there are suspicions of chemical attack. If the population is within a building, there is need to most away from the contaminated zones. Moreover, the public must block their noses and mouth using wet cloths to minimize contamination. If the chemical attack happens in open areas, the response is still the same except the public is expected to move far away from the source of contamination. Finally, if the chemical attack takes place while the person is inside a vehicle, it is advisable to move out and take shelter at a less contaminated place. Otherwise, the motorist must lock all windows to prevent the chemical contamination from taking place. The same procedure such as covering the mouth, nose and eyes should follow as the public pay attention to any additional instructions via radio or television from the respective disaster and emergency authorities⁵⁵⁰.

On the biological attacks, the UAE has guidelines for intention, stabilization and aiding persons who are exposed to such contamination. Biological attacks can be transmitted as germ warfare and has ability to cause diseases in wide population. While some biological attacks are resistant to high temperature, others can be viable over long period under difficult conditions. Most biological germs can adapt to different environment and this characteristic makes them more dangerous. Whereas some

⁵⁴⁹ UAE, *Your Guide for Emergencies*, p. 46.

⁵⁵⁰ UAE, *Your Guide for Emergencies*, p. 45.

biological germs are cultured in laboratories, others can be stored in near optimal environmental conditions⁵⁵¹.

Q9: What action should the public take during biological germ disasters?

A: UN Disaster Management Team Head from the Operations Coordination Center

“During warfare, biological germs can be targeted to populations via bombs and propelled missiles. Therefore, if the population can access some protective gear, the damage or loss of life can be reduced remarkably. Biological attacks on domestic water for consumption and food material have potential of causing poisoning to the population. Some of the most notable biological agents include bacteria like *Bacillus Anthracis* causing anthrax, Sars, Chickenpox and Q-Fever among others. In other cases, the biological agents have some toxins, which emit ricin organism that affect humans”.

There are specific steps to be taken whenever there is suspicion of biological attack. The affected persons must avoid contaminating others. The area contaminated must also be located and demarcated to avoid others access. The affected person should move to uncontaminated areas. If possible, the person or their caretakers must dial 999 for help. The affected person must clarify their location for ease of reach by the emergency services. While the emergency services are mobilizing, the affected persons should try to access showering facilities with running water and soap and possible clean clothing⁵⁵².

Fires are the other common type of non-natural disasters that occur in the UAE. First can occur in huge buildings whether residential or official and many people can be trapped in seeking rescues efforts. Some of the areas that have previously experienced catastrophic fire incidences include large supermarkets and malls, medical facilities, learning institutions, farms and factories. It is important for facilities to have fire drills so that the occupants can be prepared for actual event. Additionally, all buildings are expected to have essential firefighting equipment such as hose pipes, extinguisher cans and blankets in preparations for different classes of fire. Moreover, dialing 999 immediately for the multi-agency response to activate must alert all fires incidences⁵⁵³.

There are elaborate guidelines on course of action to respond to fires at different scenes. If the fire ignites at homes and specifically in the kitchens, the operatives are

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⁵⁵² UAE, *Your Guide for Emergencies*, p. 50.

⁵⁵³ UAE, *Your Guide for Emergencies*, p. 94.

required to remove the burning food and attempt to put off the source of fire before evacuating. Otherwise, safety comes first and the operative need to just bolt out of the house and reach extinguisher or raise alarm. It is advisable for cooks to wear fireproof clothes while in the kitchen to reduce incidences of heat burns⁵⁵⁴.

Q10: How can the public limit fire incidences and associated disasters?

A: National Disaster Management Coordinator from Support in Environmental Emergencies

“There are precautions that can reduce incidences of fires in buildings. These include avoiding overloading electrical plug-in, use of good quality electrical cords and equipment. For homes that use coal as source of energy, it is imperative to put off the remaining fire after cooking or heating sessions. Moreover, inflammable materials must be away from the kitchen as these can easily ignite fires. The fire exit ways must be clear and accessible at all times including for the disabled persons. Children’s festive celebrations that involve firecrackers must be supervised and away from other flammable areas. The remaining firecrackers must be locked away safely”.

According to the UAE emergency guidelines, installation of smoke detectors for houses and offices is a noble idea because it will raise initial alarm so that the occupants in the building can evacuate in time. Normally, there should be at least one smoke detector per room for efficiency purposes and this has to be in top-notch form. Other general precautions to avoid mass burns, injuries or loss of lives during fire incidences include avoiding crowding at places or blocking access ways. Moreover, the fire equipment must be at marked or visible locations including the assembly points. As soon as the fire alarms are sounded, electrical and gas systems must turn off to avoid spreading to other places⁵⁵⁵.

The Federal Authority for Nuclear Regulations FANR is tasked with managing handling and disposal of radioactive materials. Additionally, the UAE has a legislative framework for dealing with such events following a law passed in 2009 only to face a challenging incidence in 2011⁵⁵⁶.

Q11: What action should respective authorities take during a radiology leakage event?

⁵⁵⁴ UAE, *Your Guide for Emergencies*, p. 95.

⁵⁵⁵ UAE, *Your Guide for Emergencies*, p. 97.

⁵⁵⁶ Nuaimi, p. 13.

A: Federal Authority for Nuclear Regulations Disaster Manager

“During the October 25th 2011 loss of radiography equipment, there was collaboration among the Abu Dhabi Police, Health Authority of Abu Dhabi, FANR, the concerned firm, NCEMA and the Ministry of Interior. Earlier on, various agencies responsible for managing radioactive disasters had been building capacity in different ways. First, there was a mock drill in March 2012, which incorporated the Sharjah Police to ascertain their disaster preparedness. Second, in March 2013, another mock drill was done involving Fujairah Police for similar objectives. In the case of the misplaced radioactive the concerned firm license was revoked until confirmation that all the system gaps that led to the loss of equipment were addressed.”

The Abu Dhabi disaster risk assessment was time based on the last decade’s events that have caused loss of lives and destruction of property. Even though some situations could have improved since the occurrence of specific disaster events, this study timing was to check the preparedness of institutions, population and government if problems were to recur. This study did not have any life threatening disaster as of the time of conduct; however, the report has potential of indication for the Abu Dhabi preparedness within 72 hours window of any event⁵⁵⁷.

The Abu Dhabi assessment observed authenticity of information since they have varied strengths and weaknesses. This was important to avoid generalization because the UAE does not have uniform geographical features for disaster vulnerability. Therefore, the researcher eliminated such biases. The researcher reached some rational assumptions because the research had given period for completion. Whenever there were language barriers, an interpreter was sought and this process was particularly helpful in understanding disaster issues from a cultural and local view. For example, some disasters are associated with taboos⁵⁵⁸. Nevertheless, the use of interpreter’s aspect of confidentiality with the study was addressed by seeking their prior permission to the interviews. In the discussion of the findings, there was triangulation of the literature sources, interviews and the risk assessment report⁵⁵⁹.

⁵⁵⁷ Ibid

⁵⁵⁸ UAE- Ministry of International Cooperation and Development & OCHA – United Nation Office for the Coordination of Humanitarian Affairs, p. 27.

⁵⁵⁹ Ibid, p. 28.

12.4 SWOT Analysis

A content analysis of the responses of the respondents on the expert elicitation questionnaire was carried out. There were five questions in the questionnaire and twelve expert responses were elicited. These responses were studied in detail for suggestions, mechanisms, actions, strategies etc. given by the experts for disaster risk mitigation. Interestingly, the analysis revealed the experts saw some strength and weakness in the existing disaster mitigation mechanism.

It was considered appropriate to perform a “Strength, Weakness, Opportunities and Threats” Analysis (SWOT Analysis) from the suggestions, mechanisms, actions, strategies etc. extracted from the responses of the respondents. The SWOT Analysis is presented below.

The SWOT Analysis shown below reveals several vital points to be taken into serious action by decision makers for best results in actual situations. The Question Number and Answer Number against which the response was given by the experts are also mentioned in the four quadrants.

SWOT ANALYSIS

STRENGTHS

Q1; A2: The public staying in areas prone to lightning are advised to remain on lower or open areas because this minimizes the probability of lightning strike. Additionally, those in the seas or oceans are advised to come to the shores whenever possible.

Q2; A3: The emergency numbers to call are circulated to the public before or during the flooding events to activate any urgent evacuation needs.

Q2; A4: Relevant government agencies have devised ways of predicting their possible events and warning the public to stay safe and reduce property damages and loss of lives.

Q2; A4: The capacity of the UAE authorities to detect any potential seismic movements is beneficial to the public because they shall be informed on procedures of taking safety measures.

Q3; A3: All reports of injured and missing persons are followed up for assistance under the leadership of Civil Defence working in collaboration with other agencies. A mini census of the people in the affected location follows to account for all and determine the extent of economic damage they have experienced.

Q3; A3: The UAE disaster teams have compiled a rescue kit that includes a first aid box, manual, a pocket radio, a portable battery lamp, fire extinguisher, gas leak detectors and tools for repair of leakages, ladders and emergency numbers to reach respective rescue agencies.

Q3; A3: For persons trapped under building rubbles, the UAE has outlined additional mechanism to improve their survival rates.

Q5; A1: There are specific guidelines from the UAE government on course of action following the events of landslide.

Q5; A2: In the period after the landslide disaster, the public is advised to keep of the location and avoid turning on utilities until when declared safe by the local authorities and Civil Defence.

Q5; A2: UAE advices families and individuals to stock up food and water enough for about two weeks in case some disaster strikes and limits public mobility to retail stores or markets.

Q5; A2: The UAE government has provisions for gas or fuel rationing during disaster emergencies to ensure fair distribution of limited supplies.

Q5; A2: Generally, the UAE advices families and individuals to stock up food and water enough for about two weeks in case some disaster strikes.

OPPORTUNITIES

Q2; A3: One mechanism that the UAE government is using to deal with floods is by providing the public with metrological reports of oncoming heavy rains.

Q2; A4: Latest technologies have been useful in detecting early signs.

Q3; A3: For persons trapped under building rubbles, the UAE has outlined additional mechanism to improve their survival rates.

Q4; A1: UAE is fairly shielded from the path of Tsunamis.

WEAKNESSES

Q1; A1: Regional government is supposed to map out areas that are prone to lightening from either research or experience. Such areas should have notices on safe sheltering and advice to the public not to carry around metallic material or stand under trees or bushes.

Q2; A2: In some places in the UAE, past floods were associated with disease breakout since the consumable water was contaminated. Prolonged floods lead to famine especially where the population relies on agriculture as the main source of food and fields submerge.

Q4; A1: Disabled persons who may not be able to evacuate with speed should be assisted up elevated housing facilities so that they can await specialized rescue operations in due course. For persons who are in ships or other water vessels, it is advisable to sail towards the shorelines because the deep seas can be trouble spots.

Q5; A2: The public must only react to official information from the respective government rescue teams and agencies because rumours are not useful in disseminating information.

THREATS

Q1; A2: Some telephone lines have previously caused electric shock during lightning events.

Q2; A4: A common mistake by many people during flooding is to attempt to get into cars and drive away. However, this can be a disastrous move because the divers may not be away if the road beneath is still intact.

Q2; A4: Historically, earthquakes and tremors have proved a challenge to the people in UAE due to the abrupt events.

Q2; A4: Earthquakes have caused changes in the sea levels, leading to incidences of Tsunamis that causes destruction of transport and communication infrastructure, property and harmed livelihood.

Q3; A2: Mass calling of emergency numbers will cause a jam of the network and communication failure

Q3; A3: Tsunamis are another category of natural disasters that have tested the preparedness and resolve of the UAE government and its collaborative agencies.

Q4; A1: UAE has had various incidences of landslides.

Source: Ahmed Al Marzooqi 2017

The number of Strengths, Weaknesses, Opportunities and Threats listed in the quadrants are as below:

SWOT Parameter	Number of Items
Strengths	12
Weaknesses	4
Opportunities	4
Threats	7

12.5 Findings

It has been observed that the experts indicated more number of “strengths” in the system (12) as compared to the “Weaknesses” (4). The measures namely, creating public awareness about disaster preparedness, circulation of emergency contact numbers, detection of potential seismic movements, taking a mini census in the affected areas post the disaster events, provision of rescue kits, provisions for gas or fuel rationing during disaster emergencies etc. were identified as “Strengths”. The weaknesses were only few compared to strengths.

Four “Opportunities” namely, availability of a mechanism in the UAE government to deal with floods by providing the public with metrological reports of oncoming heavy rains, use latest technologies in detecting early signs, outlining additional mechanism for persons trapped under building rubbles to improve their survival rates, and the natural advantage of UAE that it is fairly shielded from the path of Tsunamis. However, seven threats were identified by the experts which is much higher the four opportunities. In conclusion, as against 16 Strengths and Opportunities, there were 11 Weaknesses and Threats. Thus, the positive factors of Strengths and Opportunities far outweigh the negative factors of Weaknesses and Threats, thus suggesting that the disaster mitigation mechanism in place in UAE is reasonably resilient.

CHAPTER 13: CHECKLIST APPROACH FOR DISASTER RISK ASSESSMENT

13.1 Introduction

The Hyogo Framework for Action (HFA) is a 10-year plan to make the world safer from natural hazards. It was endorsed by the UN General Assembly in the Resolution A/RES/60/195 following the 2005 World Disaster Reduction Conference. The three strategic goals of the HFA are:

- The integration of disaster risk reduction into sustainable development policies and planning
- Development and strengthening of institutions, mechanisms and capacities to build resilience to hazards
- The systematic incorporation of risk reduction approaches into the implementation of emergency preparedness, response and recovery programs.
- The HFA places five Priorities for Action with the corresponding key activities for each priority action.

The UAE adopted the Hyogo Framework for Action (HFA)⁵⁶⁰ standard checklist in the case of Abu Dhabi and UAE to assess various risks. The HFA standard checklist was chosen because it is flexible and adaptable in many countries. Additionally, the findings of the HFA checklist can be followed up immediately as each section points to the most responsible personnel, team or organization for corrective action and timeframe.

The HFA checklist is very inclusive of most humanitarian situations that can arise during emergencies and disasters, including the populations' vulnerability, institutional capacities and resourcefulness. The HFA checklist also prioritizes issues using a scoring system so that the persons responsible can focus and minimize risks appropriately. There are specific strengths that the HFA⁵⁶¹ sphere manual offers to studies of this nature. First, the HFA checklist act as a standard reference point of disaster risk assessment that is applicable in many places consistently and action can be rapid and precise. Second, the HFC checklist is objective and has provision for key or core performance indicators that the corrective action personnel can follow up systematically. Third, the HFA checklist

⁵⁶⁰ *Hyogo Framework for Action*, 2005 – 2015.

⁵⁶¹ *Hyogo Framework for Action*, 2005 – 2015.

can be used to mitigate risks without biases because the initial and final assessment has consistent findings and therefore indicators can be triangulated collectively. Finally, using the HFA, a predetermined format of reporting findings is possible and this is not time consuming for the persons or organizations expected to take action⁵⁶².

13.2 Abu Dhabi and UAE Progress Report on the Implementation of the Hyogo Framework for Action (First Cycle) – Risk Assessment, Gap Finding and Recommendations

Table 35: Disaster Risk Assessment Checklist, Gap Findings and Recommendations

Priority for Action and Core Indicator ⁵⁶³	Question related to Abu Dhabi and UAE Context	Level ⁵⁶⁴ of Progress	Description of Progress & Achievements ⁵⁶⁵
Priority for Action 1: <i>Ensure that disaster reduction is a national and local priority with a strong institutional basis for implementation</i> Core Indicator 1.1 National policy and legal framework for disaster risk reduction exists with decentralized responsibilities and capacities at all levels.	How well are local organizations (including local government) equipped with capacities (knowledge, experience, official mandate) for disaster risk reduction and climate change adaptation?	Level 5	Abu Dhabi has a Public Health and Safety Department that brings together all the major partners in disaster management and risk reduction. These include international agencies, field experts, national and local organizations that have interest in disaster management. These partners meet face to face or share some professional platforms where they review tasks. Some of the disasters that have been successfully managed by these partners include floods, sand storms and outbreak of diseases.

⁵⁶² UAE- Ministry of International Cooperation and Development & OCHA – United Nation Office for the Coordination of Humanitarian Affairs, p. 25.

⁵⁶³ *Hyogo Framework for Action*, 2005 – 2015,

⁵⁶⁴ Ibid

⁵⁶⁵ Ibid

	To what extent do partnerships exist between communities, private sector and local authorities to reduce risk?	Level 3	Abu Dhabi Municipality has constituted a Disaster Management Committee whose leadership is by the Police. Among the members of the committee are the Civil Defense, Abu Dhabi Health Authority, Road and Transport Authority, and Abu Dhabi Electricity and Water Authority. All these partners cooperate to ensure that Abu Dhabi has the required standards to participate during any disaster alerts.
Core Indicator 1.2 Dedicated and adequate resources are available to implement disaster risk reduction plans and activities at all administrative levels.	How far does the local government have access to adequate financial resources to carry out risk reduction activities?	Level 5	Abu Dhabi has various partners (as noted above) each with contingency budgets to spend during disasters. Additionally, the Abu Dhabi ruler in coordination with the nation's president often chips in additional funding depending on the scale of disaster. Part of the fund goes directly to the affected persons while the rest is for property reconstruction and relief. The private sector such as businesses, charity, NGOs also assist during such disastrous times according to the needs and lobbying for assistance.
	To what degree does the local government allocate sufficient financial resources to carry out DRR activities, including effective disaster response and recovery?	Level 5	Abu Dhabi governor has been very active in assisting situations that are or near disastrous proportions. Some of the assistance include funds, temporary shelter, food, clothing and security. Additionally, Dubai Municipality has established a mapping system to locate every property so that any emergency alerts can be mobilized rapidly and those affected get assistance. In the coming years, Abu Dhabi governor will invest on refining the geo mapping project so that the people's addresses can update in line with global best practices.
Core Indicator 1.3 Community participation and decentralization are ensured through the delegation of authority and resources to local levels.	How much does the local government support vulnerable local communities (particularly women, elderly, infirmed, children) to actively participate in risk reduction decision-making, policy making, planning and implementation processes?	Level 3	Abu Dhabi government should encourage regular meetings among communities, business owners, agencies and other bodies to discuss the state of emergency and socio-economic vulnerability.

	How regularly does the local government conduct awareness building or education programs on DRR and disaster preparedness for local communities?	Level 3	The Abu Dhabi disaster management and risk reduction does is not adequate in addressing cultural diversity aspects. Moreover, the systems are not gender inclusive as males dominate in numbers. Therefore, it is imperative that the Abu Dhabi government reviews the Emirates disaster response plan and carry out drills to test it effectiveness during actual disaster events. Learning institutions, hospitals, workplaces and other organizations need inclusion in such drills.
Core Indicator 1.4 A national multi-sectorial platform for disaster risk reduction is functioning.	To what extent does the local government participate in the national DRR planning?	Level 5	The Abu Dhabi Disaster management Committee has accomplished some emergency drills to ensure public awareness on course of action especially for non-natural disasters. These drills are done annually and huge populations are involved at private and public places.
Priority for Action 2: Identify, assess and monitor disaster risks and enhance early warning Core Indicator 2.1 National and local risk assessments based on hazard data and vulnerability information are available and include risk.	To what degree does the local government conducted thorough disaster risk assessments for key vulnerable development sectors in your local authority?	Level 3	The Abu Dhabi disaster management committee was constituted following baseline studies of various public and private entity vulnerability to impact. The committee was also set up after extensive consultations, analysis of past case studies, scrutiny of the managers' roles, projection of the new risks, and collaboration with public and private authorities. The purpose for this initial risk assessment should be to ascertain Abu Dhabi's prospects to business continuity and risk reduction capacity whenever disaster strikes.

	To what extent are these risk assessments regularly updated, e.g. annually or on a bi-annual basis?	Level 5	Abu Dhabi has various levels of risk assessment updates depending on their vulnerabilities. Thus, some are updated every 6 months, yearly and two years according to their resource intensity. These risk assessments also capture resource realignment and new strategies.
	How well are disaster risk assessments incorporated into all relevant local development planning on a consistent basis?	Level 5	Abu Dhabi has a Disaster Management Policy where every section of the Municipality has outlines their high risk areas and facilities after a comprehensive initial risk assessment. Each Municipality department has also stated their response capability so that partnership mobilization can be on alert. Some of the areas covered by the Abu Dhabi Disaster Management Policy include landslides and other tectonic movements, sea tides, air pollution, flooding, infrastructure and safe housing among others.
	To what extent have local schools, hospitals and health facilities received special attention for "all hazard" risk assessments in your local authority?	Level 4	Abu Dhabi has not completes risk assessment for all schools and medical institutions. However, Abu Dhabi Municipality Public Health and Safety Department inspects schools and hospitals to ensure they have acceptable level of compliance.
	How safe are all main schools, hospitals and health facilities from disasters so that they have the ability to remain operational during emergencies?	Level 4	Some schools and hospitals in Du Dhabi are not safe from disasters. There is need to walk through these institutions daily activities to identify all risks and indicate management ways.
Core Indicator 2.2 Systems are in place to monitor, archive and disseminate data on key hazards and vulnerabilities	What systems are in place?	Level 2	Abu Dhabi systems for gathering information, monitoring risks, documenting events and communication with the public and other stakeholders is still work in progress.

Core Indicator 2.3 Early warning systems are in place for all major hazards, with outreach to communities.	To what extent are early warning centres established, adequately staffed (or on-call personnel) and well resourced (power backups, equipment redundancy etc.) at all times?	Level 3	Abu Dhabi has elaborate drainage systems to ensure there is no flooding during heavy rains. The road and rails have automated control systems to direct and minimize accidents. Abu Dhabi has an earthquake / tremor monitoring mechanism, which can point at the epicenter of events. Additionally, Abu Dhabi has weather-monitoring stations that are useful for motorists' updates via media broadcasts.
	How much do warning systems allow for adequate community participation?	Level 1	Abu Dhabi needs to improve on the public inclusion on warning during disaster warning especially by considering multiple language for the international migrants.
Core Indicator 2.4 National and local risk assessments take account of regional / trans-boundary risks, with a view to regional cooperation on risk reduction.	How well are local government risk assessments linked to, and supportive of, risk assessments from neighbouring local authorities and state or provincial government risk management plans?	Level 4	The Abu Dhabi local government is proactive if regular risk assessments. The findings are shared with all the relevant authorities and gaps included in future plans.
Priority for Action 3: Use knowledge, innovation and education to build a culture of safety and resilience at all levels Core Indicator 3.1 Relevant information on disasters is available and accessible at all levels, to all stakeholders (through networks, development of information sharing systems, etc.).	How regularly does the local government communicate to the community, information on local hazard trends and risk reduction measures (e.g. using a Risk Communications Plan) including early warnings of likely hazard impact?	Level 4	Abu Dhabi has established a network of knowledge sharing and awareness on different types of disasters. There are different avenues of communicating with the public including mass media, telephones, e-mails and public meetings. Some of the relevant information that is communicated to the public include seismic activities, rise in sea levels, rapid change in wave frequency and air pollution of foggy conditions among others. Abu Dhabi Disaster Management Committee relays information about any alerts, recovery and rescue operations so that respective partners can deliberate their operations. Abu Dhabi conveys part of the disaster information to the public via multiple media.

Core Indicator 3.2 School curricula, education material and relevant trainings include disaster risk reduction and recovery concepts and practices.	To what degree do local schools and colleges include courses, education or training in disaster risk reduction (including climate related risks) as part of the education curriculum?	Level 3	Some Abu Dhabi Primary, Secondary and Tertiary institutions are yet to include courses in disaster management and risk reduction even though the ministry of education has role a blue print to assist such education and training. Some schools heads contend that the information needs to be prepared to be age appropriate especially for those in primary schools because everybody is vulnerable to some sort of disaster.
Core Indicator 3.3 Research methods and tools for multi-risk assessments and cost benefit analysis are developed and strengthened	Is there a specific methodology for risk assessment and cost benefit analysis in Abu Dhabi?	Level 3	Abu Dhabi has adopted risk assessment tools from HFA and other Emirates to assist the process. However, the area of cost benefit analysis still needs more work from the authorities.
Core Indicator 3.4 Countrywide public awareness strategy exists to stimulate a culture of disaster resilience, with outreach to urban and rural communities.	Is Abu Dhabi having a culture of disaster resilience for all?	Level 4	Abu Dhabi has a local, regional and national disaster awareness strategy, starting with sirens, mass media, meetings, information desks newsletters and public notices to entrench a culture of public awareness and outreach during disasters.
Priority for Action 4 Reduce the underlying risk factors Core Indicator 4.1 Disaster risk reduction is an integral objective of environment related policies and plans; including for land use, natural resource management and adaptation to climate change.	How well integrated are local government DRR policies, strategies and implementation plans with existing environmental development and natural resource management plans?	Level 5	For the last two decades, Abu Dhabi has a robust surveillance system of the activities at the coasts, shorelines, land and air. Abu Dhabi has an elaborate monitoring plan that is projected to know endangered species and resource needs.

	How far do land use policies and planning regulations for housing and development infrastructure consider current and projected disaster risk (including climate related risks)?	Level 4	Abu Dhabi is still working on policies and regulations to direct housing, infrastructure and energy resources since these are valuable to the Municipality. Abu Dhabi has an elaborate land use program stipulating all forms of uses. The objective of the land use program is to monitor construction, protect erosion and ensure infrastructure is serviceable at the time. Abu Dhabi also ensures that the water and sewerage drainage systems are serviceable and not contaminated with the irrigation and drinking sources. Abu Dhabi has a plan for land waste disposal to limit pollution using hazardous materials.
	How well are risk-sensitive land use regulations and building codes, health and safety codes enforced across all development zones and building types?	Level 5	Abu Dhabi enforces land use codes whether at urban or nearby locations to conserve the environment. Abu Dhabi has a legal system to enforce the land use codes. Moreover, regular environmental risk assessments and health and safety audits are carried out to ensure compliance with regulations and specifications. Third party audits are also scheduled to verify the respective land use projects.
	How strong are existing regulations (e.g. land use plans, building codes etc.) to support disaster risk reduction in your local authority?	Level 3	Abu Dhabi has various Municipality Inspectors who go around sites and buildings to ensure they are safe and mapped under a GIS system. All new buildings must be included in the maps so that planning and implementation of safety and emergency procedures can be effective. The GIS maps also improve the security of population. However, Abu Dhabi needs to increase supervision of strict land use because some projects are in utter violation of the town planning codes. Such wayward project further jeopardizes the health, safety and surveillance of the Municipality. The relevant Municipal Authority needs to strengthen the vacation and demolition of all illegal structure that lack license from the relevant authorities. This risk assessment did not find string evidence that the Abu Dhabi staffs have been adhering to such laws and regulations.

	To what degree does the local government support the restoration, protection and sustainable management of ecosystems services? How much do civil society organizations and citizens participate in the restoration, protection and sustainable management of ecosystems services?	Level 4	Abu Dhabi is very proactive in supporting various ecosystems. These include re-forestation, conservation of shorelines and wetlands, decontamination of water points, preservation of river basins and responsible fishing practices. Abu Dhabi monitors all shores real time using scientific, manual and submarine techniques. This monitoring includes the physical condition, chemical composition, biological quality, wavelengths, speed and directions, pollution types among others. Other issues monitored include shoreline erosion and rising levels due to flooding incidences.
	How much do civil society organizations and citizens participate in the restoration, protection and sustainable management of ecosystems services?	Level 4	Abu Dhabi received regular reports from civil society and environmental conservation groups who press for conservation and sustainable development.
	How much does the private sector participate in the implementation of environmental and ecosystems management plans in your local authority?	Level 4	Abu Dhabi received reports from Non-Governmental Organizations that are involved in specific ecosystem management in liaison with the Municipality.
Core Indicator 4.2 Social development policies and plans are being implemented to reduce the vulnerability of populations most at risk.	What is the scope of financial services (e.g. saving and credit schemes, macro and micro-insurance) available to vulnerable and marginalized households for pre- disaster times?	Level 2	Abu Dhabi has no history of major disaster that called for massive financial assistance. Therefore, most individuals and businesses have stable financial services including saving and lending institutions together with insurance companies.
	To what extent are micro finance, cash aid, soft loans loan guarantees etc. available to affected households after disasters to restart livelihoods?	Level 3	Abu Dhabi has numerous micro finance institutions since it is also emerging as the financial hub of the nation.

Core Indicator 4.3 Economic and productive sectorial policies and plans have been implemented to reduce the vulnerability of economic activities.	How well established are economic incentives for investing in disaster risk reduction for households and businesses (e.g. reduced insurance premiums for households, tax holidays for businesses)?	Level 1	Abu Dhabi has not had any major disaster in the last decades, therefore such economic incentives, if they exist not been tested.
	To what extent do local business associations, such as chambers of commerce and similar, support efforts of small enterprises for business continuity during and after disasters?	Level 1	Same as above
Core Indicator 4.4 Planning and management of human settlements incorporate disaster risk reduction elements, including enforcement of building codes.	How adequately are critical public facilities and infrastructure located in high-risk areas assessed for all hazard risks and safety?	Level 4	Abu Dhabi has built sufficient protection around the municipality to prevent flooding and other effects of harsh weather.
	How adequate are the measures that are being undertaken to protect critical public facilities and infrastructure from damage during disasters?	Level 3	Same as above for critical facilities and infrastructure
Core Indicator 4.5 Disaster risk reduction measures are integrated into post disaster recovery and rehabilitation processes.	How well are disaster risk reduction measures integrated into post disaster recovery and rehabilitation activities (i.e. build back better, livelihoods rehabilitation)?	Level 2	Abu Dhabi Municipal Managers have ensured that there are enough temporary shelters whenever need arises such as sand storms that destroy weak buildings or structures. However, more needs to be done to improve the coordination efforts to avoid delays or duplication of roles.

Core Indicator 4.6 Procedures are in place to assess the disaster risk impacts of major development projects, especially infrastructure	To what degree does local government or other levels of government have special programs in place to assess schools, hospitals and health facilities for maintenance, compliance with building codes, general safety, weather-related risks etc.?	Level 2	Abu Dhabi Municipality has no department that regularly supervises special programs in learning institutions and health facilities to certify their readiness to cope during disasters. Abu Dhabi Municipality needs to do more for major institutions buildings and those in other facilities. Of importance is the public health status of these institutions to be inspected as regularly as possible and the heads of non-complying places should be sanctioned accordingly.
Priority for Action 5: Strengthen disaster preparedness for effective response at all levels Core Indicator 5.1 Strong policy, technical and institutional capacities and mechanisms for disaster risk management, with a disaster risk reduction perspective are in place.	Does Abu Dhabi have a strong policy monitoring disaster risk reduction?	Level 1	Abu Dhabi policy needs strengthening for disaster risk reduction
Core Indicator 5.2 Disaster preparedness plans and contingency plans are in place at all administrative levels, and regular training drills and rehearsals are held to test and develop disaster response programs.	How regularly are training drills and rehearsal carried out with the participation of relevant government, non-governmental, local leaders and volunteers?	Level 4	Abu Dhabi Disaster and Risk Management Committee enforce the safety drills so that more institutions, communities and organizations are more prepared for any eventualities.

	How available are key resources for effective response, such as emergency supplies, emergency shelters, identified evacuation routes and contingency plans at all times?	Level 4	Abu Dhabi Municipality needs to improve on their relief supplies stocks, temporary shelter supplies, safety exit routes and communal preparedness for different types of disasters. One ways of assessing the adequacy of the above supplies and facilities is to carry out mock drills and check if the surging population at Abu Dhabi can cope. However, Abu Dhabi Municipality has acquired modern communication systems to help in management during disasters.
	To what extent does the local government have an emergency operations centre (EOC) and/or an emergency communication system?	Level 5	Abu Dhabi Municipality has a 24 / 7 call center for all sorts of emergencies and disaster alerts including receiving views from the public about how services and systems can improve.
	How aware are citizens of evacuation plans or drills for evacuations when necessary?	Level 3	Abu Dhabi has plans of using the Civil Defense to evacuate people whenever disaster strikes. Previously, the Civil Defense accomplished some drills to that effect for fire evacuation procedures and assembly points. All the relevant institutions such as medical, learning, communication and business communities were involved in these drills. There were about 150 drills in 2010; 250 drills in 2011; and 575 in 2012.
	To what degree does the Contingency Plan (or similar plan) include an outline strategy for post disaster recovery and reconstruction, including needs assessments and livelihoods rehabilitation?	Level 2	Abu Dhabi Municipality engages various agencies and organizations in relief and recovery plans for disasters, by gauging their capacity, reliability, resources and other contributions.
	How far are regular disaster preparedness drills undertaken in schools, hospitals and health facilities?	Level 5	Abu Dhabi Municipality schools and hospitals need to do more such drills.

Core Indicator 5.3 Financial reserves and contingency mechanisms are in place to support effective response and recovery when required.	To what degree do local institutions have access to financial reserves to support effective disaster response and early recovery?	Level 4	Abu Dhabi Municipality has robust systems for measuring, evaluating disasters to effect early warnings.
	How much access does the local government have to resources and expertise to assist victims of psycho-social (psychological, emotional) impacts of disasters?	Level 2	Abu Dhabi Municipality has outlined duties for all the disaster management partners.
Core Indicator 5.4 Procedures are in place to exchange relevant information during hazard events and disasters, and to undertake post-event reviews.	Does Abu Dhabi have a platform for exchanging information during disaster events all the way to end of operations?	Level 3	Abu Dhabi Municipality information system is work in progress.

Source: Ahmed Al Marzooqi 2017

13.3 Gap Analysis

The data gathered from the checklist above are tabulated below for further analysis. The gap between the actual score for level of progress achieved (score in a scale of 1 to 5) and the expected score for level of progress achieved (score 5) has been calculated and presented in the table. The actual level of progress achieved as a per cent of expected score has also been calculated.

Table 36: Abu Dhabi and UAE Progress Report On the Implementation Of the Hyogo Framework for Action (First Cycle)

Priority for Action and Core Indicators	Questions related to Abu Dhabi and UAE Context	Level of Progress Achieved (Score)	Level of Progress Expected (Score)	Gap Between Achieved and Expected Progress	Level of Progress Achieved (Per cent)
Priority for Action 1: <i>Ensure that disaster reduction is a national and local priority with a strong institutional basis for implementation</i>					
Core Indicator 1.1 <i>National policy and legal framework for disaster risk reduction exists with decentralized responsibilities and capacities at all levels.</i>	1. How well are local organizations (including local government) equipped with capacities (knowledge, experience, official mandate) for disaster risk reduction and climate change adaptation?	5	5	0	100
	2. To what extent do partnerships exist between communities, private sector and local authorities to reduce risk?	3	5	-2	60
Core Indicator 1.2 <i>Dedicated and adequate resources are available to implement disaster risk reduction plans and activities at all administrative levels.</i>	3. How far does the local government have access to adequate financial resources to carry out risk reduction activities?	5	5	0	100
	4. To what degree does the local government allocate sufficient financial resources to carry out DRR activities, including effective disaster response and recovery?	5	5	0	100
Core Indicator 1.3 <i>Community participation and decentralization are ensured through the delegation of authority and resources to local levels.</i>	5. How much does the local government support vulnerable local communities (particularly women, elderly, infirmed, children) to actively participate in risk reduction decision-making, policy making, planning and implementation processes?	3	5	-2	60
	6. To what extent does the local government provide training in risk reduction for local officials and community leaders?	4	5	-1	80
	7. How regularly does the local government conduct awareness building or education programs on DRR and disaster preparedness for local communities?	3	5	-2	60

Core Indicator 1.4 <i>A national multi-sectoral platform for disaster risk reduction is functioning.</i>	8. To what extent does the local government participate in the national DRR planning?	5	5	0	100
	Total Score/Per cent	33	40	-7	82.5
Priority for Action 2: Identify, assess and monitor disaster risks and enhance early warning					
Core Indicator 2.1 <i>National and local risk assessments based on hazard data and vulnerability information are available and include risk.</i>	9. To what degree does the local government conducted thorough disaster risk assessments for key vulnerable development sectors in your local authority?	3	5	-2	60
	10. To what extent are these risk assessments regularly updated, e.g. annually or on a bi-annual basis?	5	5	0	100
	11. How well are disaster risk assessments incorporated into all relevant local development planning on a consistent basis?	5	5	0	100
	12. To what extent have local schools, hospitals and health facilities received special attention for "all hazard" risk assessments in your local authority?	4	5	-1	80
	13. How safe are all main schools, hospitals and health facilities from disasters so that they have the ability to remain operational during emergencies?	4	5	-1	80
Core Indicator 2.2 <i>Systems are in place to monitor, archive and disseminate data on key hazards and vulnerabilities</i>	14. What systems are in place?	2	5	-3	40
Core Indicator 2.3 <i>Early warning systems are in place for all major hazards, with outreach to communities.</i>	15. To what extent are early warning centres established, adequately staffed (or on-call personnel) and well resourced (power back ups, equipment redundancy etc) at all times?	3	5	-2	60
	16. How much do warning systems allow for adequate community participation?	1	5	-4	20

Core Indicator 2.4 <i>National and local risk assessments take account of regional/trans-boundary risks, with a view to regional cooperation on risk reduction.</i>	17. How well are local government risk assessments linked to, and supportive of, risk assessments from neighbouring local authorities and state or provincial government risk management plans?	4	5	-1	80
	Total Score/Per cent	31	45	-14	68.9
Priority for Action 3: Use knowledge, innovation and education to build a culture of safety and resilience at all levels					
Core Indicator 3.1 <i>Relevant information on disasters is available and accessible at all levels, to all stakeholders (through networks, development of information sharing systems, etc.).</i>	18. How regularly does the local government communicate to the community, information on local hazard trends and risk reduction measures (e.g. using a Risk Communications Plan) including early warnings of likely hazard impact?	4	5	-1	80
Core Indicator 3.2 <i>School curricula, education material and relevant trainings include disaster risk reduction and recovery concepts and practices.</i>	19. To what degree do local schools and colleges include courses, education or training in disaster risk reduction (including climate related risks) as part of the education curriculum?	3	5	-2	60
Core Indicator 3.3 <i>Research methods and tools for multi-risk assessments and cost benefit analysis are developed and strengthened.</i>	20. Is there a specific methodology for risk assessment and cost benefit analysis in Abu Dhabi?	3	5	-2	60
Core Indicator 3.4 <i>Countrywide public awareness strategy exists to stimulate a culture of disaster resilience, with outreach to urban and rural communities.</i>	21. Is Abu Dhabi having a culture of disaster resilience for all?	4	5	-1	80
	Total Score/Per cent	14	20	-6	70

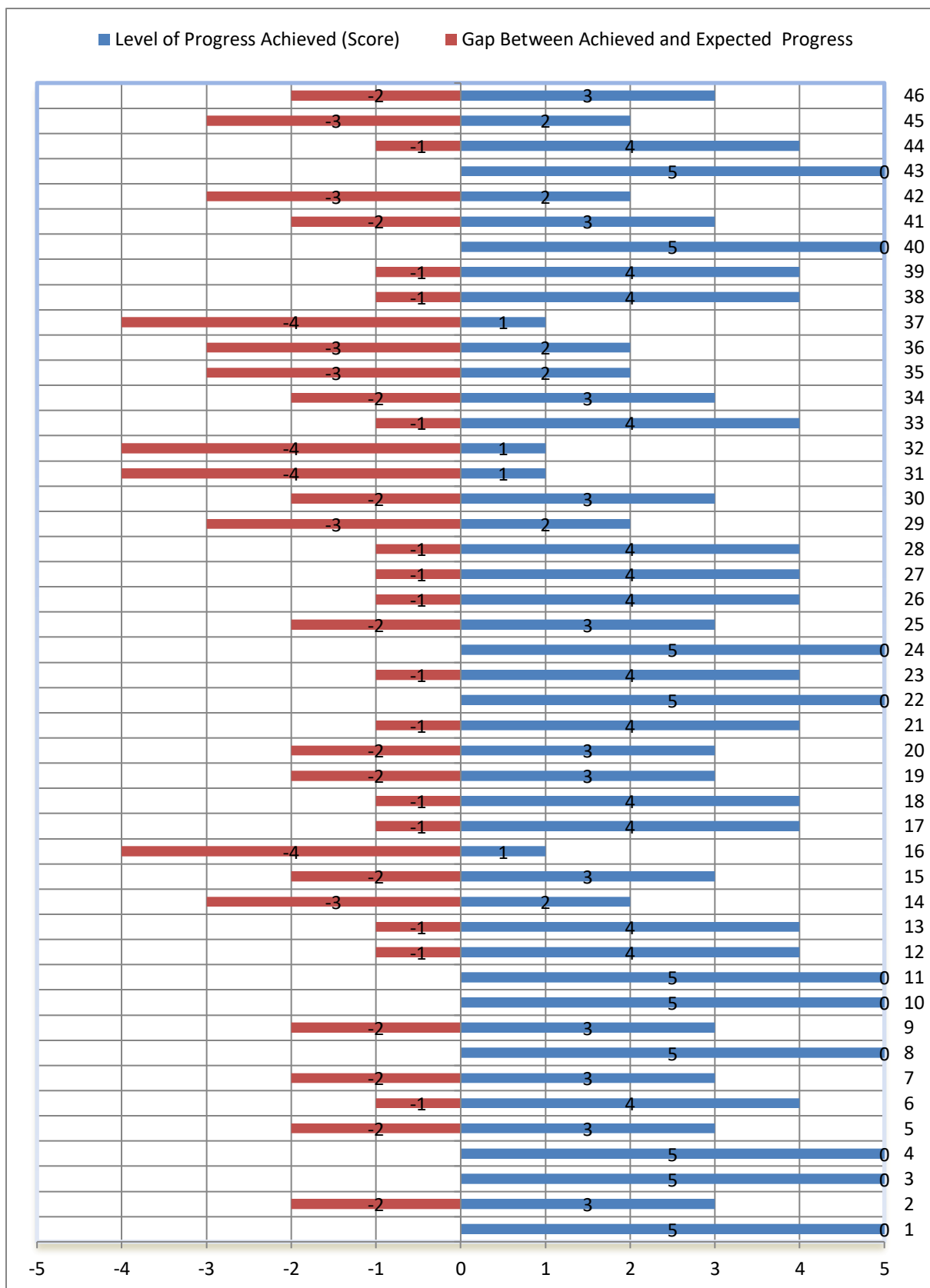
Priority for Action 4: Reduce the underlying risk factors					
Core Indicator 4.1 <i>Disaster risk reduction is an integral objective of environment related policies and plans; including for land use, natural resource management and adaptation to climate change.</i>	22. How well integrated are local government DRR policies, strategies and implementation plans with existing environmental development and natural resource management plans?	5	5	0	100
	23. How far do land use policies and planning regulations for housing and development infrastructure consider current and projected disaster risk (including climate related risks)?	4	5	-1	80
	24. How well are risk-sensitive land use regulations and building codes, health and safety codes enforced across all development zones and building types?	5	5	0	100
	25. How strong are existing regulations (e.g. land use plans, building codes etc) to support disaster risk reduction in your local authority?	3	5	-2	60
	26. To what degree does the local government support the restoration, protection and sustainable management of ecosystems services?	4	5	-1	80
	27. How much do civil society organizations and citizens participate in the restoration, protection and sustainable management of ecosystems services?	4	5	-1	80
	28. How much does the private sector participate in the implementation of environmental and ecosystems management plans in your local authority?	4	5	-1	80
Core Indicator 4.2 <i>Social development policies and plans are being implemented to reduce the vulnerability of populations most at risk.</i>	29. What is the scope of financial services (e.g. saving and credit schemes, macro and micro-insurance) available to vulnerable and marginalised households for pre-disaster times?	2	5	-3	40
	30. To what extent are micro finance, cash aid, soft loans, lone guarantees etc available to affected households after disasters to restart livelihoods.	3	5	-2	60

Core Indicator 4.3 <i>Economic and productive sectorial policies and plans have been implemented to reduce the vulnerability of economic activities.</i>	31. How well established are economic incentives for investing in disaster risk reduction for households and businesses (e.g. reduced insurance premiums for households, tax holidays for businesses)?	1	5	-4	20
	32. To what extent do local business associations, such as chambers of commerce and similar, support efforts of small enterprises for business continuity during and after disasters?	1	5	-4	20
Core Indicator 4.4 <i>Planning and management of human settlements incorporate disaster risk reduction elements, including enforcement of building codes.</i>	33. How adequately are critical public facilities and infrastructure located in high-risk areas assessed for all hazard risks and safety?	4	5	-1	80
	34. How adequate are the measures that are being undertaken to protect critical public facilities and infrastructure from damage during disasters?	3	5	-2	60
Core Indicator 4.5 <i>Disaster risk reduction measures are integrated into post disaster recovery and rehabilitation processes.</i>	35. How well are disaster risk reduction measures integrated into post disaster recovery and rehabilitation activities (i.e. build back better, livelihoods rehabilitation)?	2	5	-3	40
Core Indicator 4.6 <i>Procedures are in place to assess the disaster risk impacts of major development projects, especially infrastructure</i>	36. To what degree do local government or other levels of government have special programs in place to regularly assess schools, hospitals and health facilities for maintenance, compliance with building codes, general safety, weather-related risks etc.?	2	5	-3	40
Total Score/Per cent		47	75	-28	62.7

Priority for Action 5: Strengthen disaster preparedness for effective response at all levels					
Core Indicator 5.1 <i>Strong policy, technical and institutional capacities and mechanisms for disaster risk management, with a disaster risk reduction perspective are in place.</i>	37. Does Abu Dhabi have a strong policy monitoring disaster risk reduction?	1	5	-4	20
	38. How regularly are training drills and rehearsal carried out with the participation of relevant government, non-governmental, local leaders and volunteers?	4	5	-1	80
Core Indicator 5.2 <i>Disaster preparedness plans and contingency plans are in place at all administrative levels, and regular training drills and rehearsals are held to test and develop disaster response programmes.</i>	39. How available are key resources for effective response, such as emergency supplies, emergency shelters, identified evacuation routes and contingency plans at all times?	4	5	-1	80
	40. To what extent does the local government have an emergency operations centre (EOC) and/or an emergency communication system?	5	5	0	100
	41. How aware are citizens of evacuation plans or drills for evacuations when necessary?	3	5	-2	60
	42. To what degree does the Contingency Plan (or similar plan) include an outline strategy for post disaster recovery and reconstruction, including needs assessments and livelihoods rehabilitation?	2	5	-3	40
	43. How far are regular disaster preparedness drills undertaken in schools, hospitals and health facilities?	5	5	0	100
Core Indicator 5.3 <i>Financial reserves and contingency mechanisms are in place to support effective response and recovery when required.</i>	44. To what degree do local institutions have access to financial reserves to support effective disaster response and early recovery?	4	5	-1	80
	45. How much access does the local government have to resources and expertise to assist victims of psycho-social (psychological, emotional) impacts of disasters?	2	5	-3	40

Core Indicator 5.4 <i>Procedures are in place to exchange relevant information during hazard events and disasters, and to undertake post-event reviews.</i>	46. Does Abu Dhabi have a platform for exchanging information during disaster events all the way to end of operations?	3	5	-2	60
	Total Score/Per cent	33	50	-17	66
Summary					
Priority Area	Number of Questions	Level of Progress Achieved (Score)	Level of Progress Expected (Score)	Gap Between Achieved and Expected Progress	Level of Progress Achieved (Per cent)
1	8	33	40	-7	82.5
2	9	31	45	-14	68.9
3	4	14	20	-6	70
4	15	47	75	-28	62.7
5	10	33	50	-17	66
Cumulative Total Score/Per cent	46	158	230	-72	68.7

Source: Ahmed Al Marzooqi 2017



Source: Ahmed Al Marzooqi 2017

13.4 Findings

The summary results of the Gap Analysis are given below priority area wise:

Table 37: Gap Analysis Summary Result

Summary					
Priority for Action	Number of Questions	Level of Progress Achieved (Score)	Level of Progress Expected (Score)	Gap Between Achieved and Expected Progress	Level of Progress Achieved (Per cent)
1	8	33	40	-7	82.5
2	9	31	45	-14	68.9
3	4	14	20	-6	70
4	15	47	75	-28	62.7
5	10	33	50	-17	66
Total Score / Per cent	46	158	230	-72	68.7

It may be noted that the overall score gap that exists was 72 for 230 and the level of progress achieved was 68.7%. While the Priority for Action 1 with eight questions exhibited a gap of 7 and the highest level of progress 82.5%, Priority for Action 4 with 15 questions exhibited a gap of 28 and the lowest level of progress 62.7%. This shows that the more number of questions asked to elucidate required information, higher was the gap revealed and lesser was the progress exhibited. The lowest level of progress achieved was 62.7% for Priority for Action No.4: Reduction the underlying risk factors which suggests that risk reduction measures need more focus in the HAF Action Plan. Considering a benchmark level of progress achieved as 70%, Priority for Action No.2: Identify, assess and monitor disaster risks and enhance early warning and Priority for Action No.5: Strengthen disaster preparedness for effective response at all levels, which fall below the benchmark also need more attention.

In order to study the association between the variables, a correlation analysis was carried out. A correlation co-efficient was calculated to measure the strength of association between two variables, namely, the 'number of questions' and the 'level of progress achieved' using the following formula: $r = \frac{\sum (xy)}{\sqrt{(\sum x^2) * (\sum y^2)}}$, where $\sum$ is the summation symbol, $x = x_i - \bar{x}$, x_i is the x value for observation i, $\bar{x}$ is the

mean x value, $y = y_i - \bar{y}$, y_i is the y value for observation i , and $\bar{y}$ is the mean y value. The sign and the absolute value of a Pearson correlation coefficient describe the direction and the magnitude of the relationship between two variables. The value of a correlation coefficient ranges between -1 and 1 . The greater the absolute value of a correlation coefficient, the stronger the linear relationship. The strongest linear relationship is indicated by a correlation coefficient of -1 or 1 . The weakest linear relationship is indicated by a correlation coefficient equal to 0 . A positive correlation means that if one variable gets bigger, the other variable tends to get bigger. A negative correlation means that if one variable gets bigger, the other variable tends to get smaller.

We arrived at Correlation Co-efficient of -0.946585935 for the variable “Gap Between Achieved and Expected Progress” with respect to the “Number of Questions” asked which means that the relationship between the two variable is much stronger.

CHAPTER 14: DISASTER PREPAREDNESS PERCEPTION SURVEY

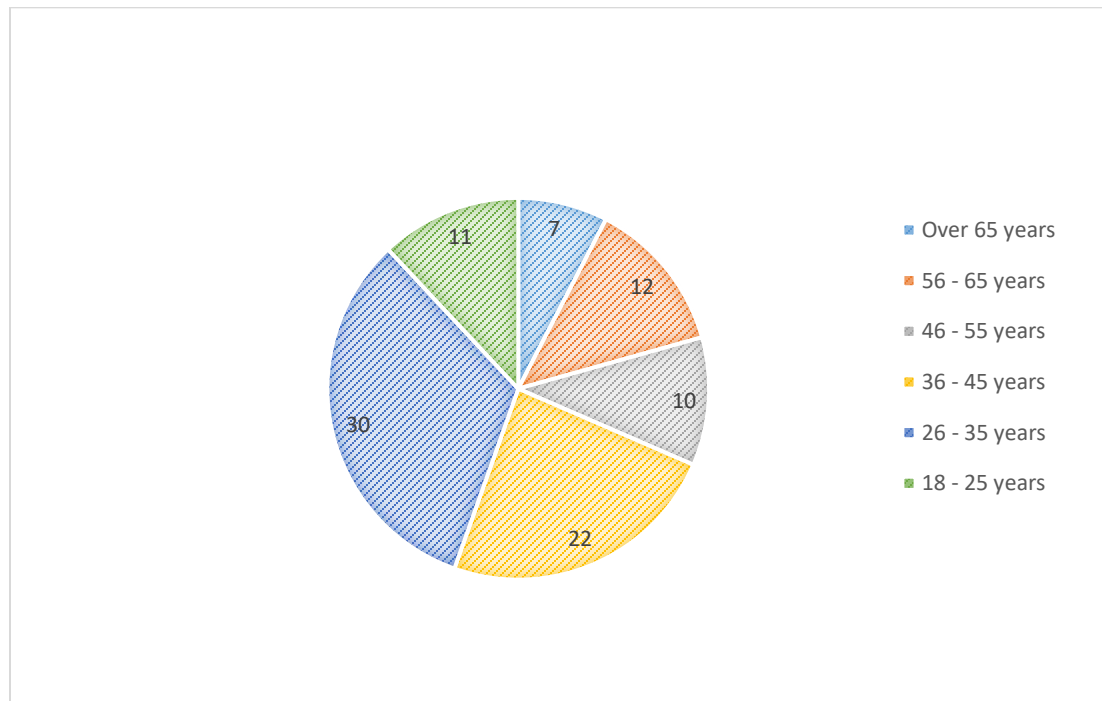
14.1 The Survey

As a part of the study, a survey was undertaken with the general public living in Abu Dhabi to determine their understanding and preparedness for natural and non-natural disasters. The importance of the survey was to gather public views because they are major stakeholders in disaster management, preparedness and risk reduction. The survey covered both business and general members of the public because they are all vulnerable to disaster impact whenever they occur. A questionnaire with eleven questions was designed for this purpose to elicit public perception on the Abu Dhabi Disaster Management preparedness during the preparedness, response, recovery and mitigation stages of the disaster. The questionnaire was mostly composed of closed ended questions to enable the respondents to be specific and hence give the researcher easy time to quantify outcomes.

One hundred questionnaires were distributed to the members of the public at random sampled respondents across different occupations. However, only 92 questionnaires were completed on our digital template and certified as reliable for analysis and discussion. The questionnaire was in two phases, demographic data and the disaster preparedness and risk management. The data was analyzed using mathematical software to establish measures from central tendencies and other finer details about Abu Dhabi and UAE state of disaster management.

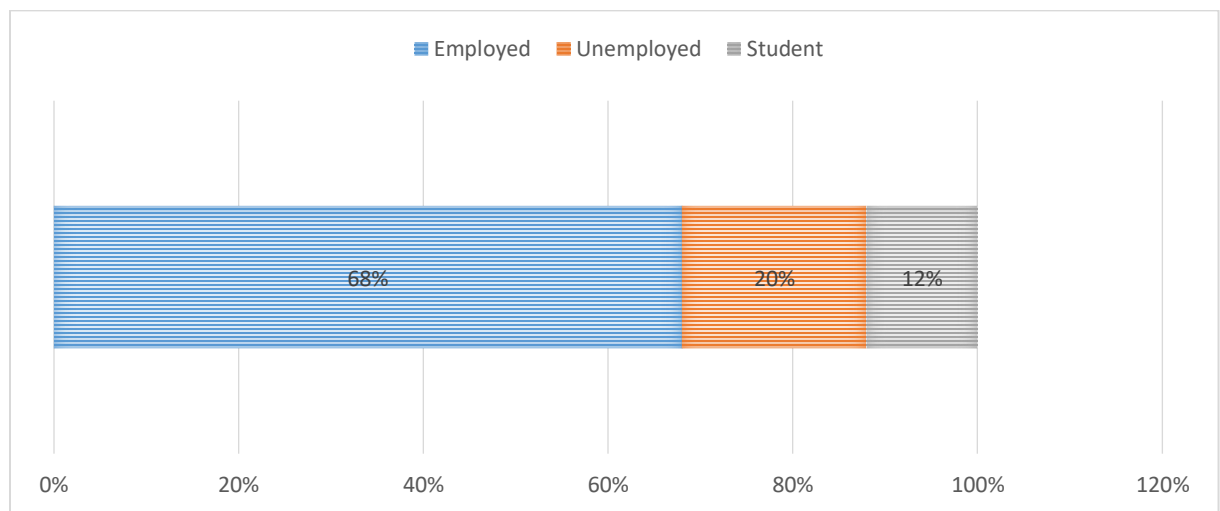
14.2 Survey Findings

We established that 63% of the survey respondents were male while 37% were female. This trend is identifiable with the demographics of Abu Dhabi and most of UAE whereby the international migrants have been coming into the country to seek various work opportunities. In terms of ages of the respondents, the most frequency was range 26 – 35 years. At this age, most of the population have completed their first level of tertiary education and are available for employment as shown below:

Figure 52: Age Bracket of Respondents

Source: Ahmed Al Marzooqi 2017

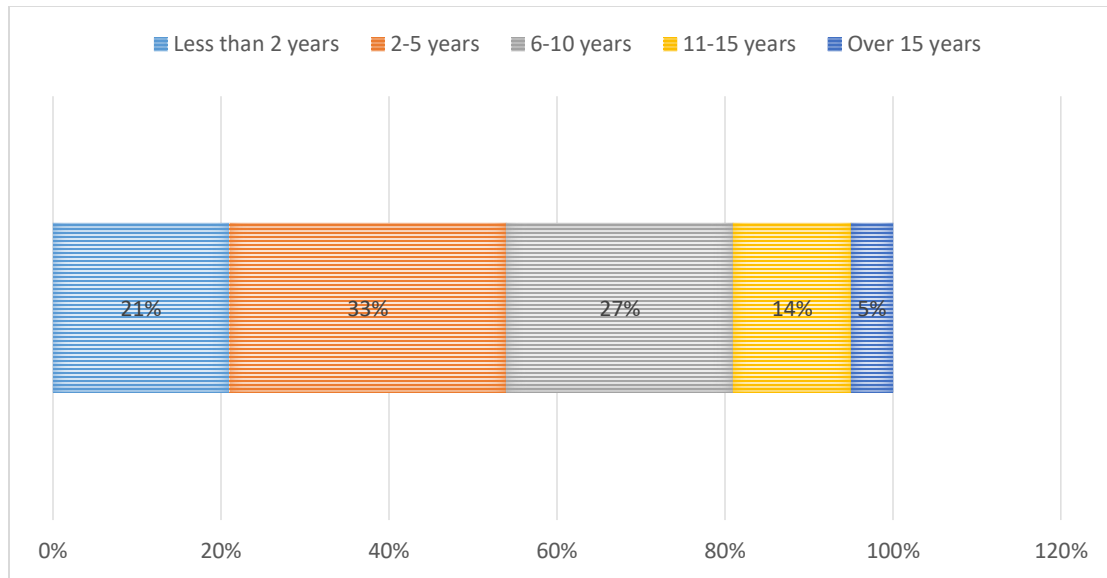
The survey on the occupation of the respondents established that 68% are employed, 20% are unemployed and 12% are students as shown in the figure below:

Figure 53: Occupation of Respondents

Among the respondents who are employed, 33% have 2-5 years of experience, 27% have 6 – 10 years of experience, 21% have less than 2 years of experience, 14% have 11-

15 years of experience and only 5% have over 15 years of experience as shown in the figure below. The importance of gauging the work experiences was to confirm knowledge of disaster management and reduction.

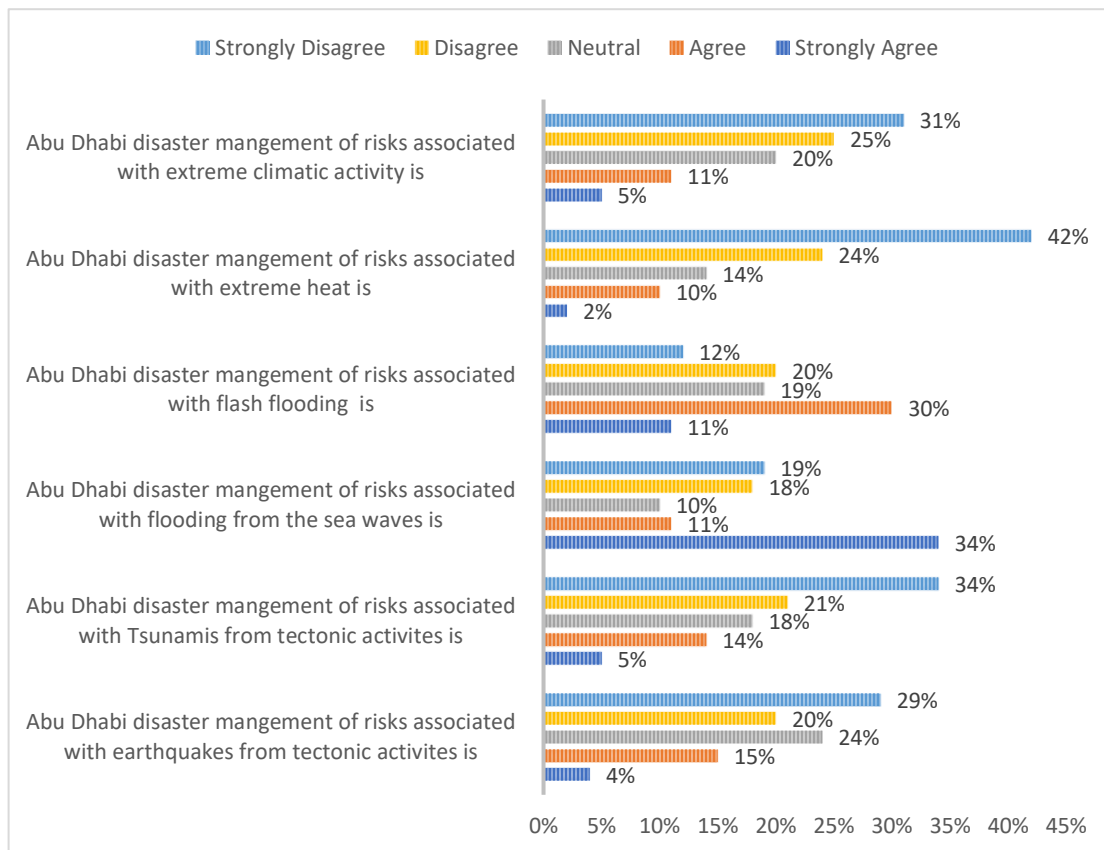
Figure 54: Work Experience



Source: Ahmed Al Marzooqi 2017

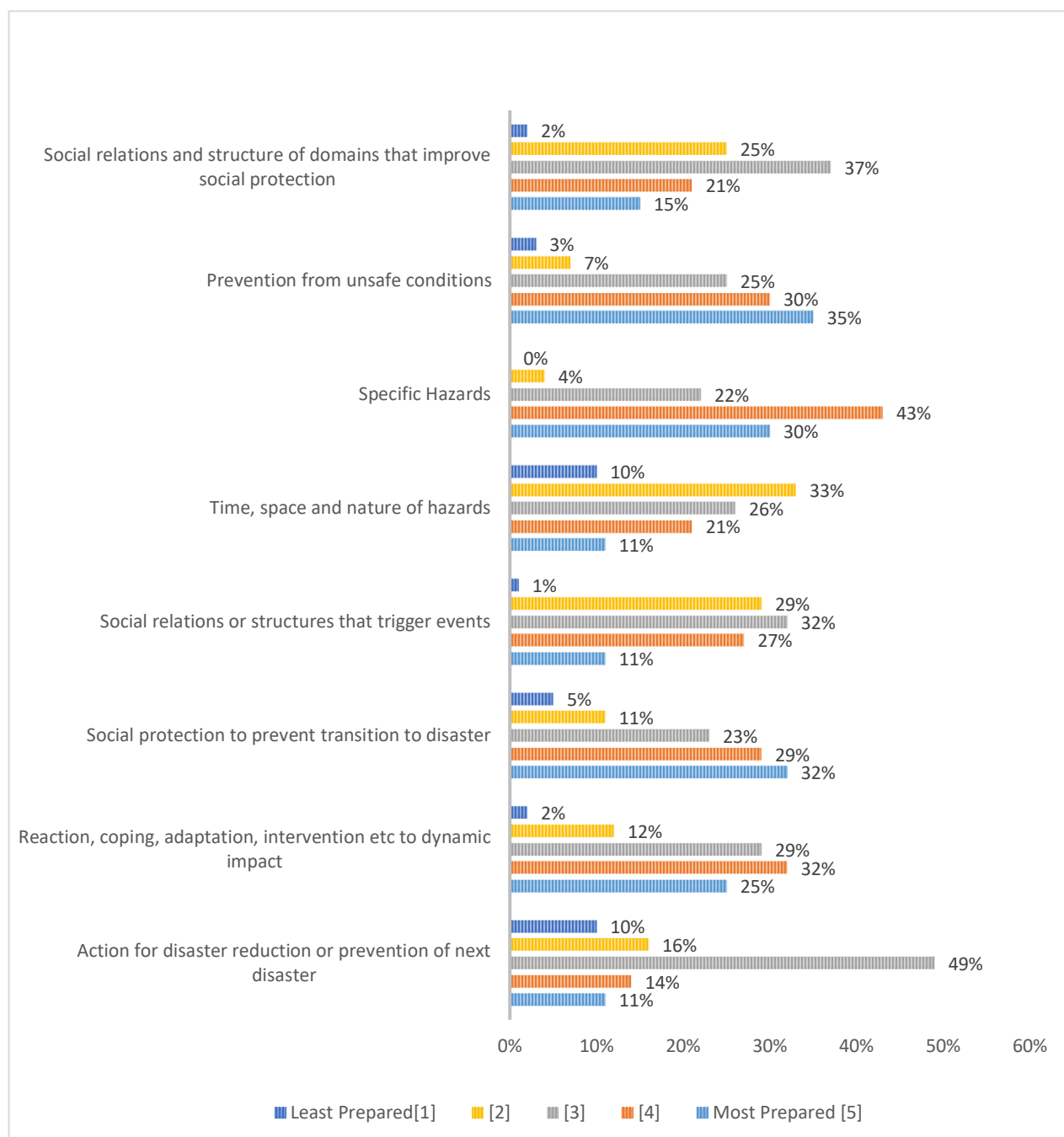
These respondents were spread across the following working areas: [A] Education [B] Health Care [C] Farming [D] Housing & Real Estate [E] Manufacturing / Processing [F] Survey / Land Economics [G] Transport [H] Communication [I] Science & Technology [J] Building and Construction / Engineering [K] Energy – Oil, Gas, Electricity, Wind, Solar, [L] Water Services [M] Textile Industry [N] Government Services [O] Others services. Each of the respondents' satisfaction with their living or working environmental preparedness for disaster management was gathered and the following are the findings.

The survey on the natural disaster preparedness established that the respondents are better for floods arising from sea waves, followed by flash floods as shown in the figure below. However the respondents acknowledge their least preparedness for risks associated with extreme weather followed by tsunamis from tectonic activities and earthquakes as shown in the figure below.

Figure 55: Natural Disaster Risk Preparedness

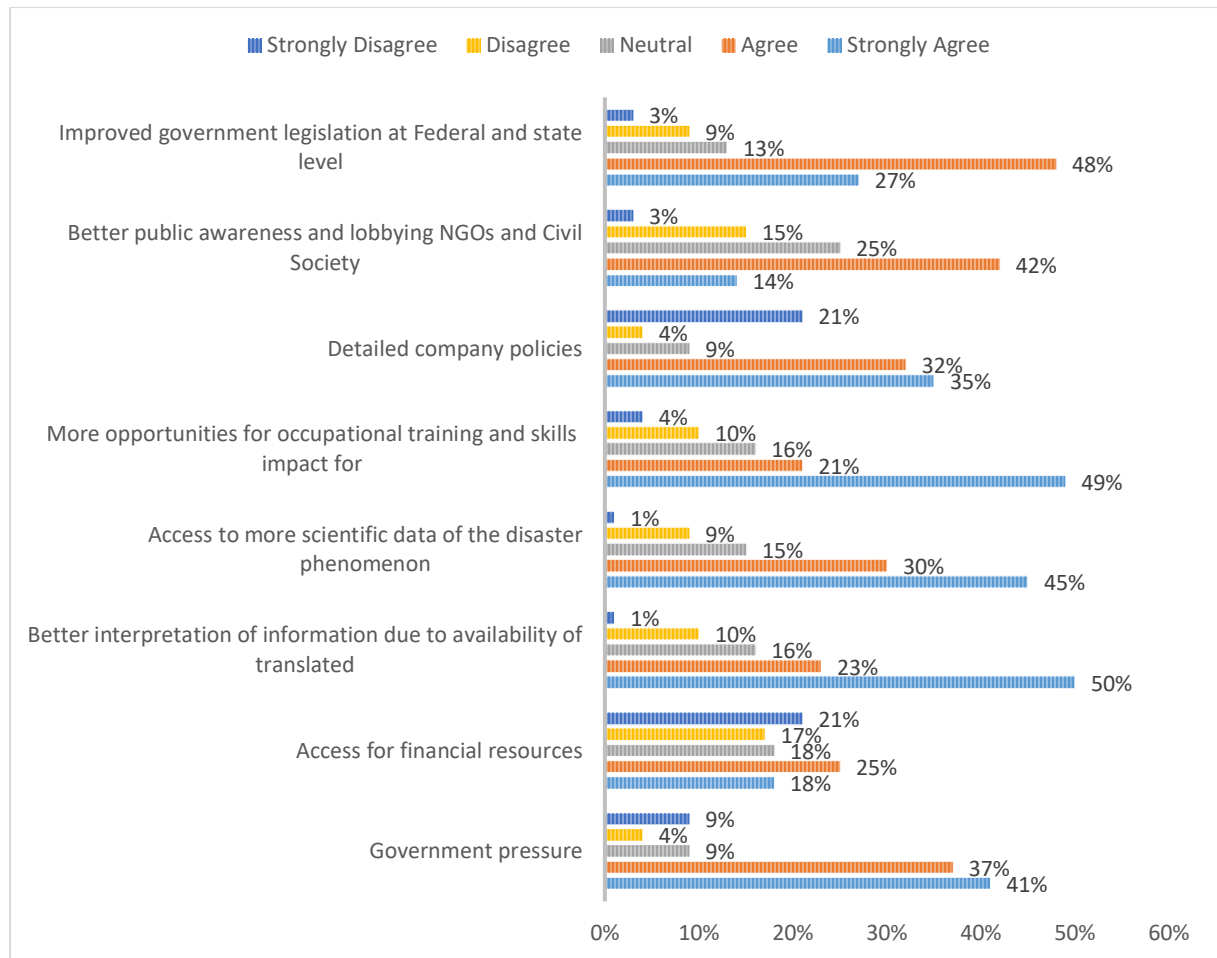
source: Ahmed Al Marzooqi

The survey on non natural disaster risk management established that respondents are most prepared risks associated with terrorisms followed by industrial explosions then fires. On the other hand the respondents stated that Abu Dhabi is least prepared on risks associated with infrustructural construction followed by car and air accidents as shown in the figure below:

Figure 56: Non-Natural Disaster Risk Management

Source: Ahmed Al Marzooqi 2017

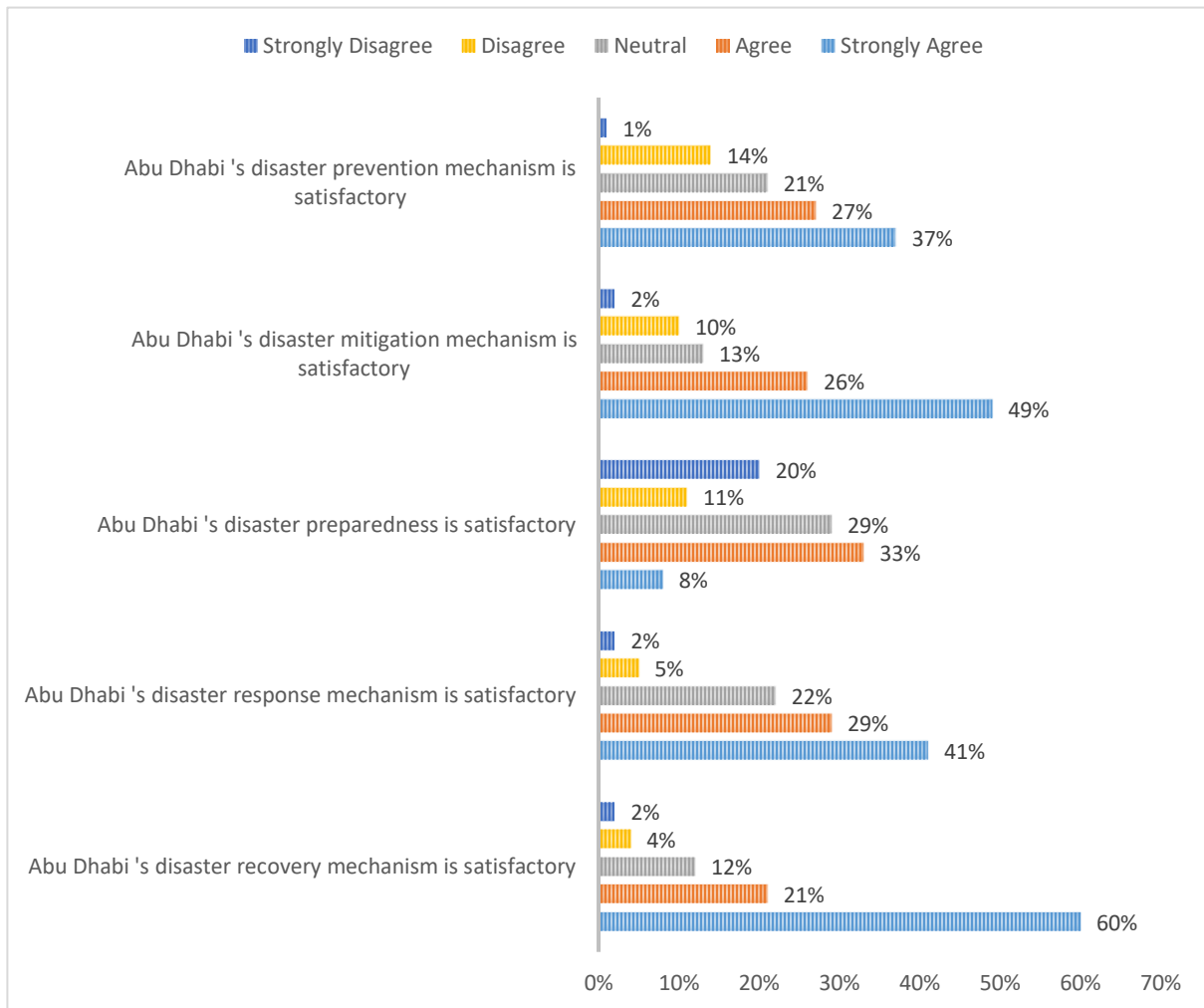
The survey “on why there is increased awareness on disaster risks among the respondents” indicated that there is more information translated in Arabic, followed by occupational training and skills impact, than availability of scientific data and statistics on different types of disasters as shown in the figure below:

Figure 57: Increased awareness to disaster risk management

Source: Ahmed Al Marzooqi 2017

From the literature review, we established that there are four stages of managing natural disaster applicable to the Abu Dhabi and UAE case study. These are response, recovery, mitigation and preparedness⁵⁶⁶. In all but disaster preparedness questions, the respondents are satisfied with the mechanism in place by the local, regional and national government and agencies.

⁵⁶⁶ Dhanhani, 2010, p. 55.

Figure 58: Abu Dhabi Disaster Risk Management Mechanism in Place

Source: Ahmed Al Marzooqi 2017

Next, we surveyed the finer components of these stages to understand the best correction action that respective organizations, agencies, government and population should undertake. The first component is the response to natural disaster as illustrated in the following figure:

Figure 59: Natural Disaster Management Response Stage

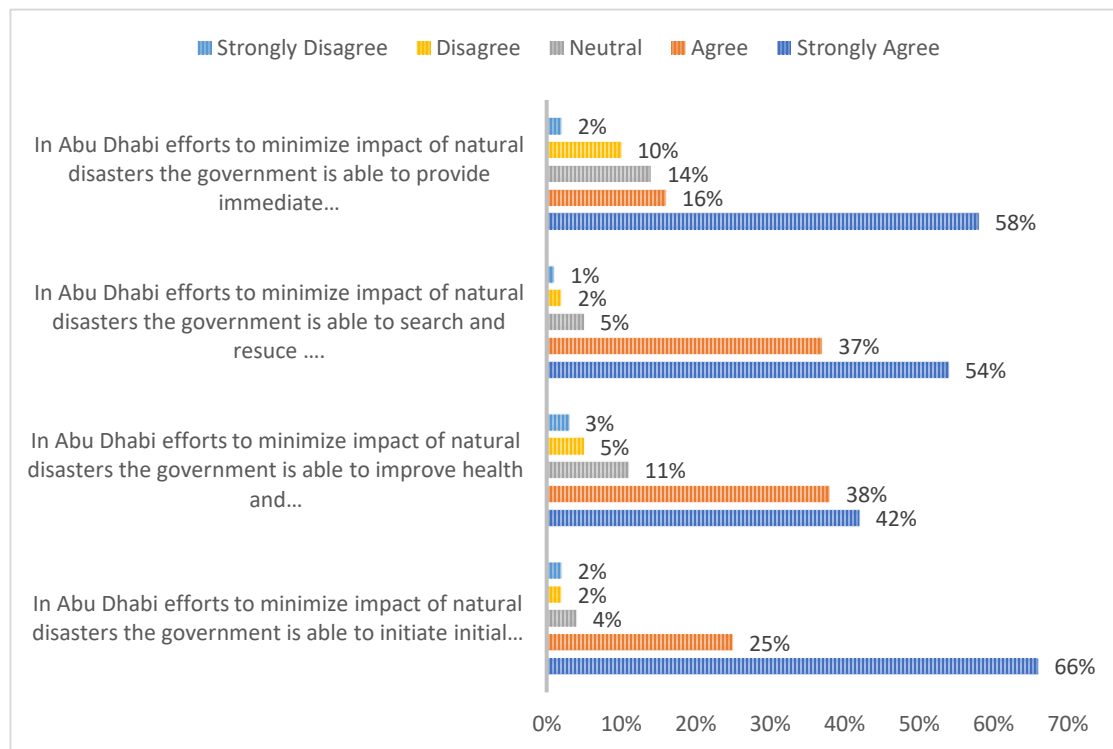


Source: Dhanhani, 2010, p. 56

During the response stage, the Abu Dhabi response teams ensure that casualties and other injured persons are received attention immediately. Additionally, the disaster response teams ensure that the survivors have all their basic needs to remain healthy and be motivated for life. The disaster response teams could also start searching for missing persons, rescue those in difficult conditions and offering relief services to the survivors. Any injured persons who require transportation to advanced medical facilities are also accorded the service immediately, while others receive food, water and temporary shelter construction materials. The disaster response teams then help the refugees or displaced persons by assigning a meeting or camping point where they can receive additional services for their welfare. If the disaster response team has capacity, the process of repairing damaged infrastructure can kick off immediately to restore transport and communication. The essence of such immediate response to different types of disaster is for damage control and for restoring social order⁵⁶⁷.

The following figure illustrates the survey findings for views on the Abu Dhabi capacity to respond to natural disasters. From the figure below, majority of the respondents at least agree with the strategy and capacity of Abu Dhabi to respond to natural disasters.

⁵⁶⁷ Dhanhani, 2010, p. 56.

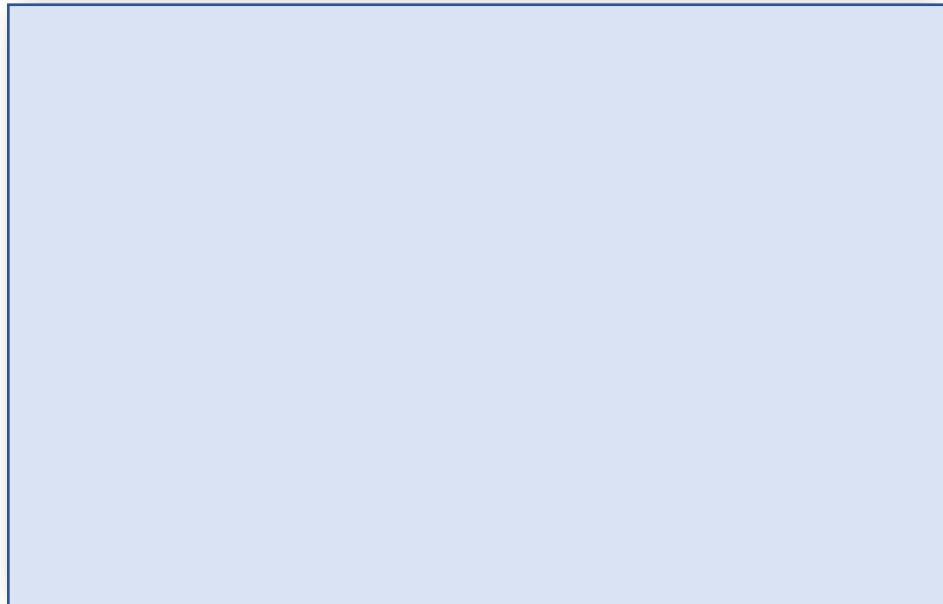
Figure 60: Response Stage

source: Ahmed Al Marzooqi

The second component is the recovery to natural disaster as illustrated in the following figure. At this stage, the disaster recovery assistance teams ensure normalcy resumes among the affected population. This process includes human recovery and reconstruction of damaged infrastructure for the sake of business continuity and sustainability. The recovery stage is also characterized by provision of temporary shelter such as tents or makeshift structures that will give the affected persons significant relief for a while as a more lasting solution is sought. The recovery stage also includes administering detailed healthcare to injured persons in the disasters. For people who lose property due to natural disasters, the recovery stage can be used to administer grants to boost their businesses. The recovery stage will prevail all the way to the full operational and social order among the affected people as shown in the figure below⁵⁶⁸.

⁵⁶⁸ Dhanhani, 2010, p. 57.

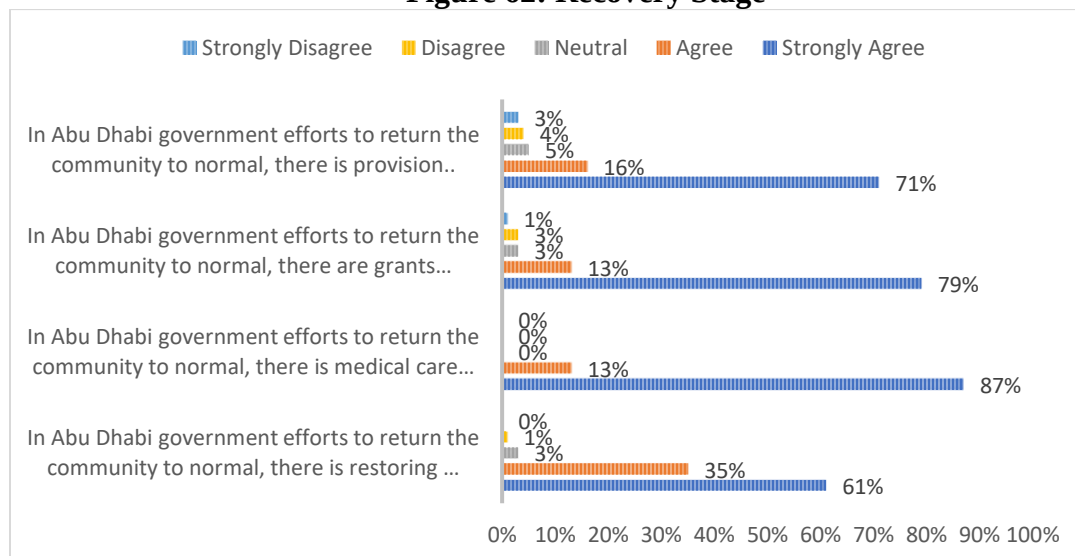
Figure 61: Natural Disaster Management Recovery Stage.



Source: Dhanhani, 2010, p. 57.

We surveyed the Abu Dhabi disaster recovery capacity and established that majority strongly agree with the government's efforts to restore and rebuild livelihoods, offer medical care, grants and subsidies for business reconstructions and build temporary shelter for affected persons. The following figure illustrates the Abu Dhabi survey findings.

Figure 62: Recovery Stage



source: Ahmed Al Marzooqi

The third component is the mitigation to natural disaster as illustrated in the figure below. This stage is a deliberate action to minimise disaster risk to the population including their safety. Therefore, the relevant agencies proceed to change the disaster triggers and the hazardous effects to the people. To that effect, the government is expected to assess risks regularly, review building and construction codes and abide by the building and construction regulations. The mitigation stage also encourages development of health facilities to handle the more complicated cases affected by disaster. The public receives educations and information about different types of hazards and ways of mitigation. Consequently, disaster management agencies create a zone to bar other peoples entry depending on the impact⁵⁶⁹. The following figure illustrates the disaster mitigation stage.

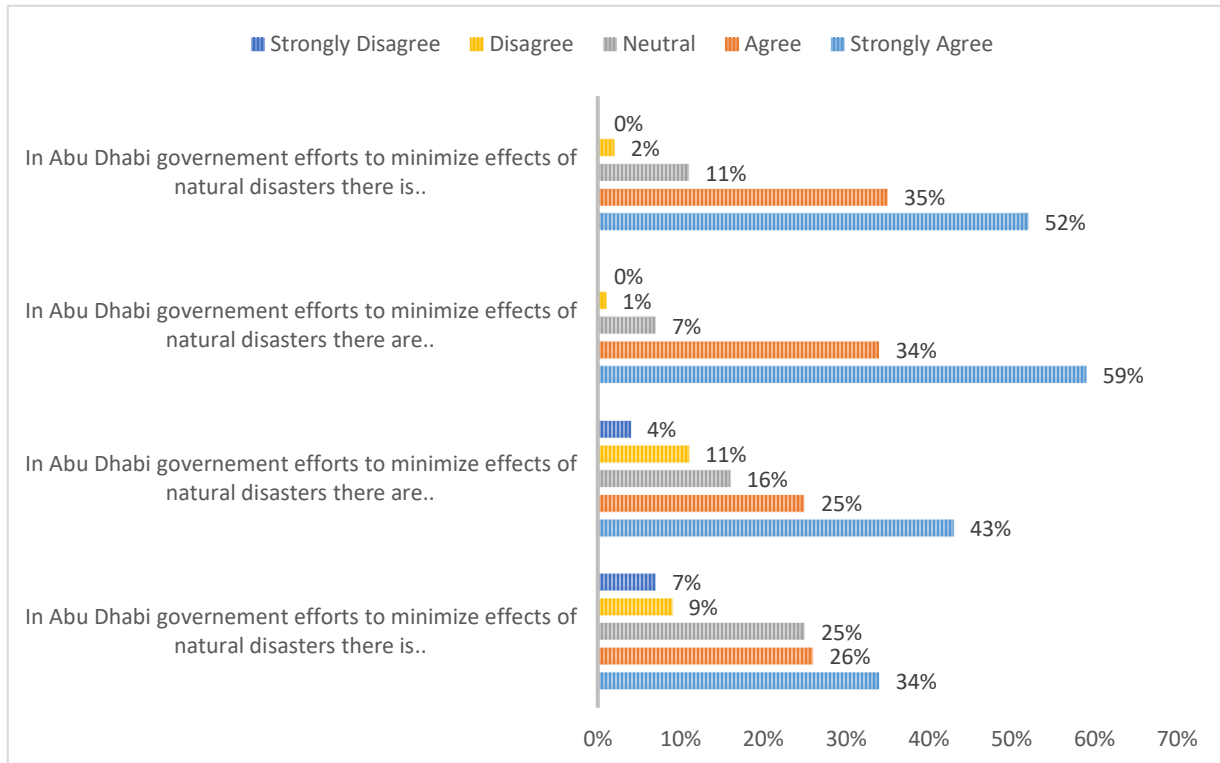
Figure 63: Natural Disaster Management Mitigation Stage.



Source: Dhanhani, 2010, p. 58.

We surveyed the public view on the mitigation capacity during natural disasters and established that the majority of the respondents tend to at least agree with the government effectiveness as shown in the figure below:

⁵⁶⁹ Dhanhani, 2010, p. 58.

Figure 64: Mitigation Stage

Source: Ahmed Al Marzooqi 2017

The fourth component is the preparedness to natural disaster as illustrated in the figure below. The preparednes stage articulates how organizatons or communities will respond rationally whenever disaster strikes. Preparedness is one way of assurance that there shall be limited damage during a disaster because the strategies and procedures are known in advance. Preparedness involves carrying out mock drills and simulations, engaging emergency response units, creating public awarness, testing the warning systems and teaching people about different types of disasters including sharing relevant data and material. Preparedness further positions emergency facilities like food, water, medical supplirs and other essential relief goods at strategic locations of networks which can be activated within the shortest time. Ultimately, prepared organizations or communities will be efficient in reacting to ny disaster alerts as shown in the figure below⁵⁷⁰.

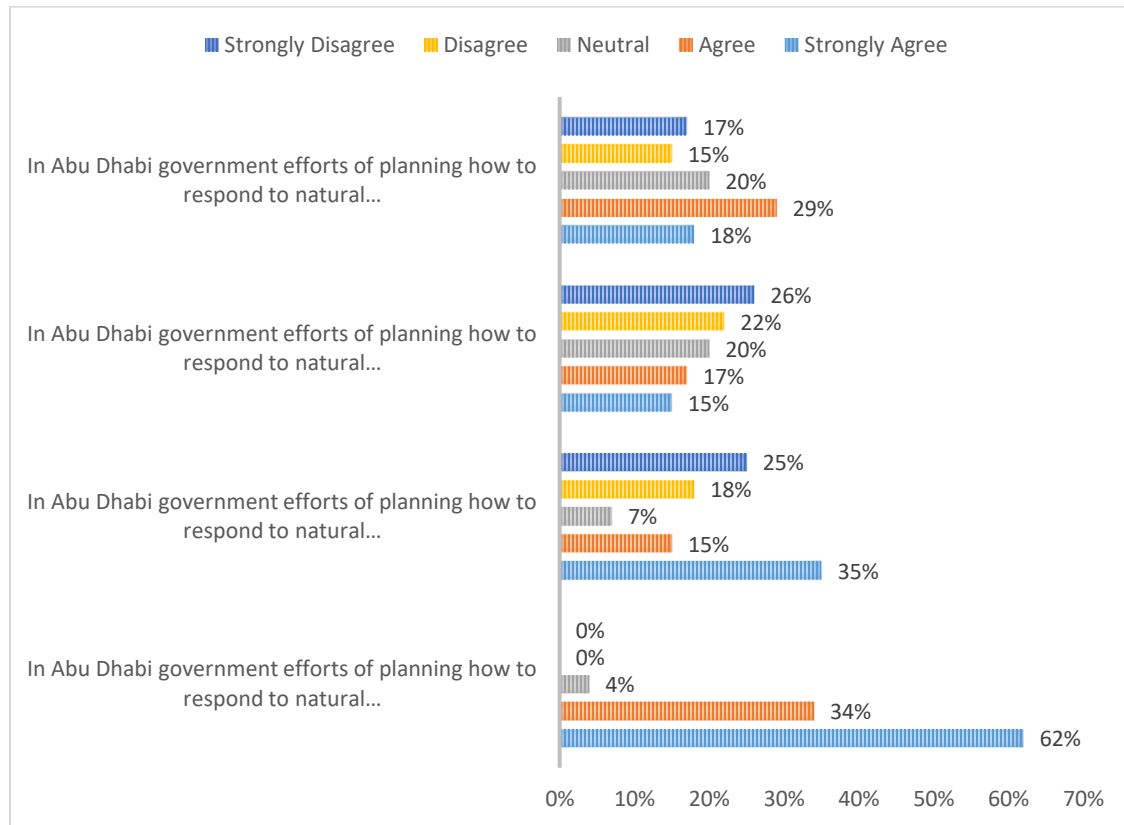
⁵⁷⁰ Dhanhani, 2010, p. 59

Figure 65: Natural Disaster Management Preparedness Stage.



Source: Dhanhani, 2010, p. 59.

We surveyed the Abu Dhabi preparedness to natural disasters and established that warning and alert systems had the highest percentage of people who strongly agree with the government preparedness for the governments' preparedness. However, the survey established that about 25% disagree strongly with intensity of training, scenario simulation or mock drills for disaster preparedness. It is partly understandable that this problem is caused by the rate of migration in and out of Abu Dhabi. Therefore, future studies should find a way of gauging this mobility rate and therefore determining the best training and mock drilling frequency that will capture majority of the people's preparedness. The surveys also indicate that the highest proportions of 26% are unaware of the disaster preparedness plans. This problem is partly attributed to the large-scale efforts to develop and circulate the plans in Arabic whereas most of the people in Abu Dhabi are probably foreigners who do not understand the language. Consequently, another 17% of the respondents strongly disagree with the Abu Dhabi disaster preparedness strategies as shown in the figure below:

Figure 66: Preparedness Stage

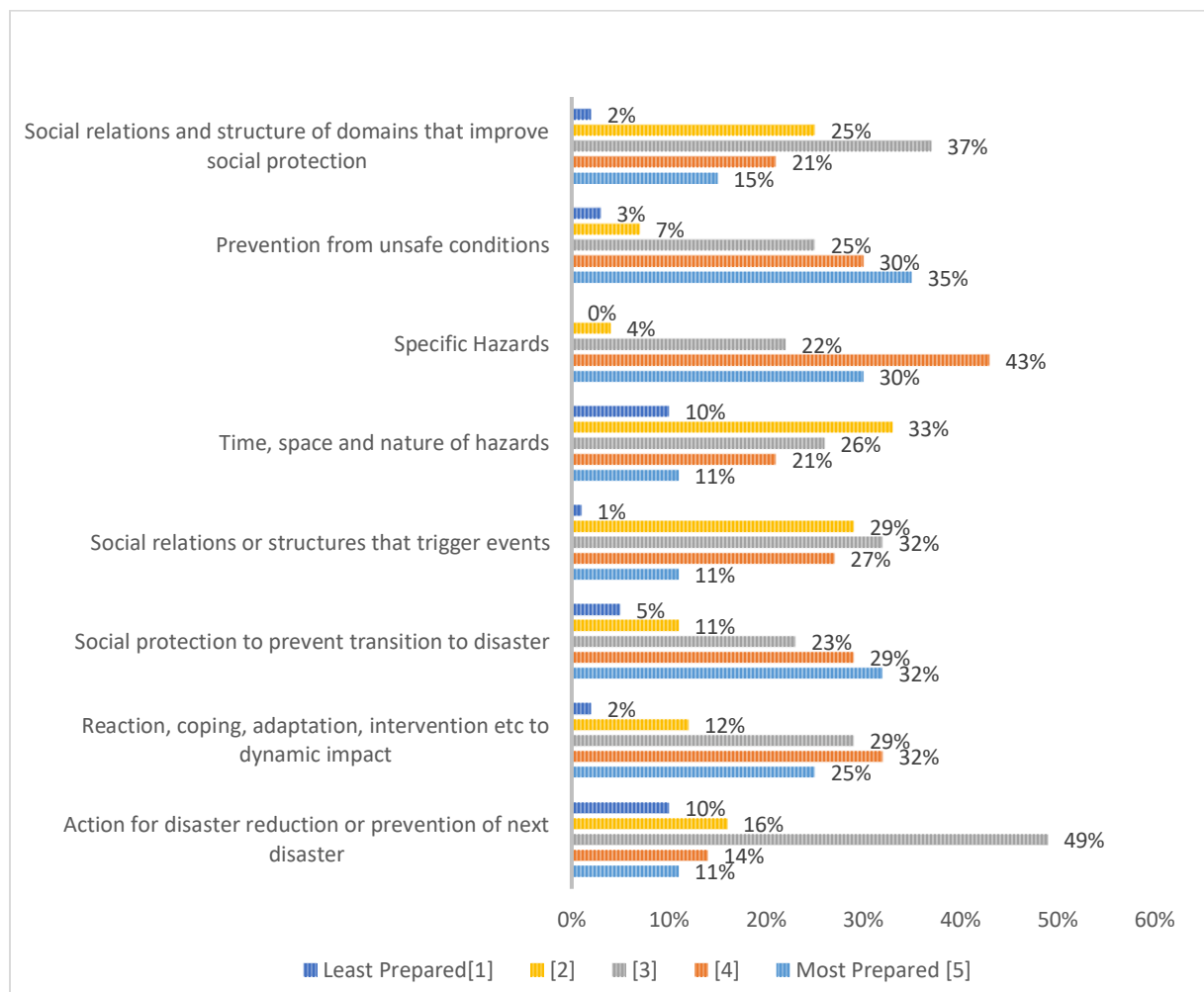
Source: Ahmed Al Marzooqi 2017

Using the disaster recovery and reconstruction model⁵⁷¹, we surveyed the Abu Dhabi, UAE situation with regard to non-natural disaster management. As illustrated in the findings below, about 49% of the respondents are neutral about the action for disaster reduction or its prevention. This neutral stand indicates that the respondents are uncertain or partially unaware of what to do which further points to the need for more education and awareness. Depending on the locality of living or work place, most of the respondents are prepared for some specific non-natural disasters. The survey of the populations ability to react, cope and adapt to different types of non-natural disaster established higher confidence towards maximum preparation. Most of the respondents are happy with the social protection to prevent escalations to non-natural disasters. However, the respondents are not prepared in time of time and space to react incase non-natural disaster strikes.

⁵⁷¹ Wisner, et al. 2003, p. 89.

There were mixed responses on the respondents understanding of the causes of non-natural disasters, probably due to the strong cultural and religious beliefs that some are caused by act of Allah. Therefore, the social relations and structures of the cause of non-natural disasters is still a controversial debate. Nevertheless, most people tend to believe that living or working in an unsafe place increases the vulnerability to non-natural disasters. Overall, majority of the respondents are neutral on the governments' social relations and structures for improving their protection from non-natural disasters. The following are the survey findings:

Figure 67: Non-Natural Disaster Recovery and Reconstruction Survey



Source: Ahmed Al Marzooqi 2017

GENERAL CONCLUSION

General Findings from the Literature Review

An extensive literature review was carried out for this study. Databases maintained by various international research organizations, the studies conducted by various institutes and the historical data pertaining to disasters were reviewed and the following findings were made.

1. A study of the Emergency Events Database (EM-DAT) managed by Centre for Research on the Epidemiology of Disasters (CRED) in Brussels indicated that the number of natural and man-made disasters was rising exponentially which caused many concerns. Data gathered working with the World Health Organization indicates that from 1900 to 2006, the sum of disasters rose by 76% globally. Additionally, the study indicated that loss of human life due to such disasters globally was 37,687,619. Overall, some 5444 recent disasters account for 1,206,688 lost lives and this trend is a major motivation for this study.
2. There is a steady rise in the number of natural and man-made disasters as seen from the data from the OFDA/CRED International Disaster Database for 1900-2004. The same figure also shows the trends in technical caused disasters especially from the industrial chemical spillages and hydrocarbon truck accidents.
3. Whereas some studies found no correlation between natural and man-made disasters, other was quite the contrary. Data from 41 nations in the African continent from 1981 to 1999 has established that civil strife slows down economic growth irrespective of the national wealth, state of democracy and ethnic cohesion. Some natural disasters occur because its causal hazards or environmental vulnerability or systems failed to live up to its prevention.
4. A study published by the World Disaster Reports (2001) by the International Federation of Red Cross and Red Crescent looked at the impact of vulnerability or impact of disasters to people. This study considered how low, medium and high

levels of Human Development Index (HDI) are affected by disasters. The study reveals that the lower the HDI, the higher the deaths and the fewer the loss of assets per disaster and the reverse is also true.

5. Many businesses often lack a disaster management policy, hence, the impact to their businesses drags on longer than expected. Additionally, many businesses tend to have disaster management policy that covers non-natural disasters while ignoring the natural situation on the pretext that the latter is unpredictable.
6. Overall, the developed nations tend to have better cushion from direct effects of disasters as compared to the underdeveloped nations. This is because the underdeveloped nations have little or no insurance for their homes, health and other social support systems. Consequently, the underdeveloped nations facing disasters tend to have more deaths and diminished savings than their developed counterparts do.
7. The more developed nations tend to be more educated, are transparent, have stronger financial management discipline, and have more national credit reserved and lesser national government conflicts. This implies they would overcome natural disaster faster than their counterparts would.
8. The type of environment or cultural exposure of the population to some biological hazards determines the impact. Therefore, if a community is used to staying at high altitudes, there are less likely to be affected by the biological hazards associated with such environments as compared to people who migrate.
9. No GCC nation was involved in the past cases of earthquake that caused serious loss of lives in excess of 5,000 from 1976 to 2015. In the numerous man-made disasters documented globally, none was in the GCC nations.

10. The UAE's geographical location around the Arabian Plate between the Iranian plateau and the Zagros Fault exposes to various natural disasters. This region has a history of seismic movements as evident from the documentation. Additionally, the population of the UAE has been growing rapidly, and the pressure for settlement areas is leading people to migrate to places deemed prone to natural disasters. Therefore, the UAE has increasingly become exposed to the same hazards.

11. UAE is the most industrialized country in the Middle East next only to Saudi Arabia. Major industrial complexes dot the skyline of Abu Dhabi and Dubai emirates. As a result, UAE has become prone to industrial disasters also.

Specific Findings from the Data Analyses

Data analysis play vital role on this research study. The data collected during the field study of the project are analyzed using various statistical methods to arrive at meaningful inferences at the following coherence.

Firstly, data was gathered through literature review to document information from the historical disaster events. A Risk Assessment was carried out from this data and the findings are presented in this chapter.

Secondly, a semi-structured questionnaire was administered among a group of experts from the disaster management team for expert elicitation. The data gathered from the answers elicited from the experts were analyzed with SWOT Analysis.

Thirdly, a Gap Analysis was made with the data gathered from the HFA Checklist administered with an expert in the field. This section presents the findings and discussions from those analyses.

1. Except for the Gonu Storm Disaster which resulted in a risk ranking "Medium risk" all the other three disaster events – floods, earthquake and landslide - ranked "Low risk".

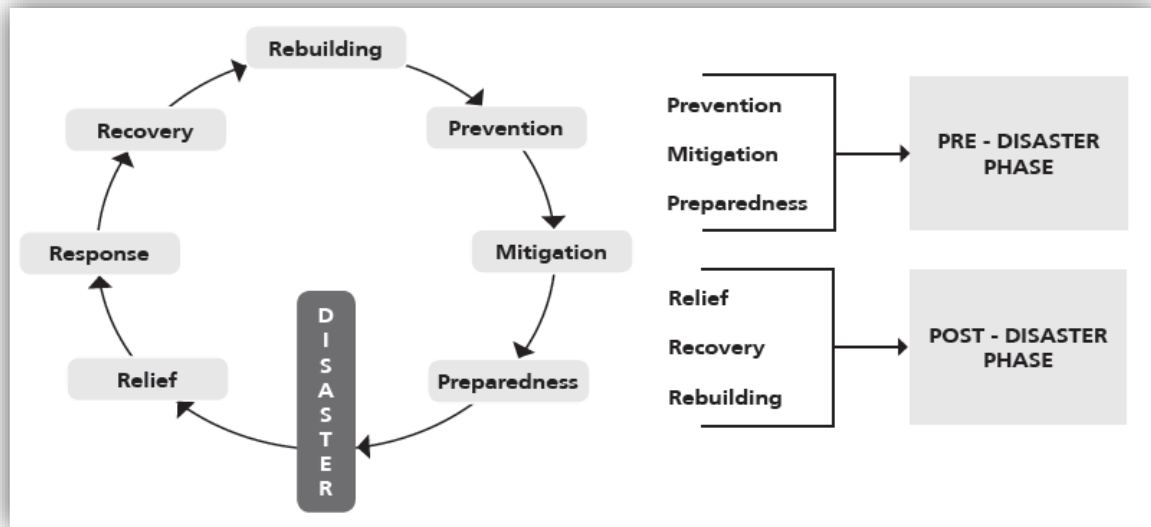
2. The data available is only for the period of 20 years. It is difficult to estimate the trend of disasters within this short period. Further analysis for a much longer duration will be required to determine trends, predictability etc.
3. It has been observed that the experts indicated more number of “strengths” in the system (12 responses) as compared to the “Weaknesses” (4 responses). The measures namely, “creating public awareness about disaster preparedness”, “circulation of emergency contact numbers”, “detection of potential seismic movements”, “taking a mini census in the affected areas post the disaster events”, “provision of rescue kits, provisions for gas or fuel rationing during disaster emergencies etc.” were identified as “Strengths”. The weaknesses were only few compared to strengths.
4. Four “Opportunities” namely, availability of a mechanism in the UAE government to deal with floods by providing the public with metrological reports of oncoming heavy rains, use latest technologies in detecting early signs, outlining additional mechanism for persons trapped under building rubbles to improve their survival rates, and the natural advantage of UAE that it is fairly shielded from the path of Tsunamis. However, seven threats were identified by the experts which is much higher the four opportunities. In conclusion, as against 16 Strengths and Opportunities, there were 11 Weaknesses and Threats. Thus, the positive factors of Strengths and Opportunities far outweigh the negative factors of Weaknesses and Threats, thus suggesting that the disaster mitigation mechanism in place in UAE is reasonably resilient.
5. The overall score gap that exists was 72 for 230 and the level of progress achieved was 68.7%. While the Priority for Action 1 with eight questions exhibited a gap of 7 and the highest level of progress 82.5%, Priority for Action 4 with 15 questions exhibited a gap of 28 and the lowest level of progress 62.7%. This shows that the more number of questions asked to elucidate required information, higher was the gap revealed and lesser was the

progress exhibited. The lowest level of progress achieved was 62.7% for Priority for Action No.4: Reduction the underlying risk factors which suggests that risk reduction measures need more focus in the HAF Action Plan. Considering a benchmark level of progress achieved as 70%, Priority for Action No.2: Identify, assess and monitor disaster risks and enhance early warning and Priority for Action No.5: Strengthen disaster preparedness for effective response at all levels, which fall below the benchmark also need more attention.

6. There were mixed responses on the respondents understanding of the causes of non-natural disasters, probably due to the strong cultural and religious beliefs that some are caused by act of Allah. Therefore, the social relations and structures of the cause of non-natural disasters is still a controversial debate. Nevertheless, most people tend to believe that living or working in an unsafe place increases the vulnerability to non-natural disasters. Overall, majority of the respondents are neutral on the governments' social relations and structures for improving their protection from non-natural disasters.

From the interviews, survey and the risk assessment reports, we find that the regional government of Abu Dhabi and the nation as a whole has not been able to break the life cycle of disasters owing to the cited gaps. This is contrary to the expectations of most risk management processes. However, Abu Dhabi and larger UAE has made significant progress in their prevention, mitigation, preparedness, and response and recovery efforts. The following is the summary model of Abu Dhabi and UAE disaster management cycle and the pre-disaster and post-disaster phases.

Figure 68: Model for Abu Dhabi Disaster Management Cycle and Phases



Source: Khaili & Patirage, 2011, p. 108.

Conclusions

We conclude that the UAE has faced numerous natural and non-natural disasters in the two last decades, which justified the conduct of this study to gauge the national and regional preparedness for future eventualities. Among the natural disasters that have befallen the UAE are atmospheric related, anthropogenic and seismic movements. With every successive disaster, the UAE has proved more vulnerable from the impact of such events. Even though data on the UAE disaster are scarce or limited, we were able to corroborate various qualitative sources with the quantitative findings to arrive reliable conclusions on natural disasters.

Furthermore, we conclude that tectonic and weather related disasters are becoming very common in the UAE owing to the geographical location of the nation. The tectonic movements, other than being natural, are also triggered by the oil drilling and infrastructural construction activities. Significant part of the UAE is a desert and this factor too makes the region extremely vulnerable to sand storms, wash away by the sea waves and flooding. In the last decade alone, there were at least 25 seismic activities recorded by the authorities. Some of the most vulnerable areas are the Zagros Thrust, Masafi and Hurmuz Straits.

Among the non-natural disasters, where Abu Dhabi exhibits great preparedness, is terrorism as a geopolitical problem. Indeed, Abu Dhabi has key installations and infrastructure that are worthy of defense from terror attacks including fires and explosions. The problem of road accidents is also a matter of concern in Abu Dhabi and UAE in general. With this foresight, it is important that different disaster management agencies and public collaborate to minimize negative impact. The process of disaster management in Abu Dhabi and UAE requires both operational and legislative preparedness so that the public have confidence. Additionally, such a measure will safeguard business process continuity, which is a major concern for the people in Abu Dhabi and UAE in general. Taking the example of the nuclear plant at Barakah, it is imperative for the UAE government and disaster management agencies to be prepared in case of any problems. We find that the Ministry of Energy plays a critical role of supporting business recovery and compensations, post disasters.

We find that the UAE has varied experiences of natural and non-natural disasters. Simultaneously, various activities in the UAE have led to environmental degradation, infrastructural developments, and competition for scarce resources. Additionally, shifting demographic features and opening up new settlement schemes each warrants a new and continuous risk management. We find that due to the different natural and non-natural disasters, there are primary and secondary risks that affect the UAE population. These are not limited to internal mass displacements, transport and communication interruptions, spreading diseases, low quality of life and productivity, food shortage, social strife and unrest. These risks become complicated with time and on wider scale compared to experiences.

We find that different types of disasters affect the UAE population and stretch the government and inter-agency resources as they all respond to the emergencies. We find that some natural and non-natural disasters have immediate effects while others have medium to long-term effects. Some of the disasters lead to permanent displacement of people and their livestock while others call for resettlement after completion of risk assessment by the respective authorities. Some disaster grounds or sites in the UAE are totally unsafe for habitation or business while others are rehabilitated and improved to avert recurrent events.

The UAE has ratified the Millennium Development Goals⁵⁷² and manages the national resources while working with multiple agencies that are signatory to the Hyogo Framework for Action⁵⁷³. The UAE also conforms to the League of Arab States in, “Promoting the integration of disaster risk reduction measures in regional policies on sustainable development, climate change adaptation and environment and disaster management coordination mechanisms”⁵⁷⁴. Moreover, we find that the UAE has different approaches for safeguarding their economic gains and opportunities and align their disaster risk management with the natural and non-natural disasters according to available information from different agencies.

The UAE government was represented at the 1st Arab Summit on Socio-Economic Development to standardize activities that target risk reduction. During this meeting, the Arab Strategy for Disaster Risk Reduction (ASDRR) was unveiled at two levels.

“- to outline a vision, strategic priorities and core areas of implementation for disaster risk reduction in the Arab region;

- to enhance institutional and coordination mechanisms, and monitoring arrangements to support the implementation of the Strategy at the regional, national and local level through preparation of a Program of Action”⁵⁷⁵.

We find that when UAE works along the ASDRR, there will be supplementary action to the national strategies and guidelines for managing disaster risks. At the national levels, there are specific agencies such as Civil Defense, Fire Department, various government ministries and non-government organizations. Additionally, there are international agencies that work along the UAE in times of disasters and these include the World Health Organization, Red Crescent Society, and International Federation for Red Cross, and Weather Satellite organizations among others⁵⁷⁶.

⁵⁷² *Millennium Development Goals in the Arab States*, Retrieved

<http://arabstates.undp.org/subpage.php?spid=20>

⁵⁷³ *Hyogo Framework for Action*, 2005 – 2015, Building the Resilience of Nations and Communities to Disasters, Retrieved <http://www.unisdr.org/wcdr/intergover/official-doc/L-docs/Hyogo-framework-for-action-english.pdf>

⁵⁷⁴ *The Arab Strategy for Disaster Risk Reduction 2020*, Report by the Council of Arab Ministers Responsible for the Environment, resolution # 345, in its 22nd session held at the League of Arab States 19-20 December 2010, p. 3. Retrieved

http://www.preventionweb.net/files/18903_17934asdrfinalenglishjanuary20111.pdf

⁵⁷⁵ *The Arab Strategy for Disaster Risk Reduction 2020*, p. 4

⁵⁷⁶ Ibid.

We find that the UAE is working with the Hyogo Framework for Action (HFA) because it has a very robust strategy for risk reduction and specifically endeavors to the following:

- “- Strengthen commitment for comprehensive disaster risk reduction across sectors.
- Develop capacities to identify, assess and monitor disaster risks.
- Build resilience through knowledge, advocacy, research and trainings.
- Improve accountability for disaster risk management at the sub national and local level.
- Integrate disaster risk reduction into emergency response, preparedness and recovery”⁵⁷⁷.

We established that the UAE has a continuous system of risk assessment and issues to be implemented using the multi-agency teams. Whereas some predictable risks have a timetable of management implementation, others require personnel and resource mobilization in advance to ease response rates as soon as alarms are raised. The UAE currently aligns to the HFA running up to 2015 and with possibility of reviewing targets beyond this period. According to the HFA obligations, we find that the UAE has segmented their tasks under the ASDRR with a target of minimizing destruction to property or assets, loss of lives, slowdown of economic growth, and degradation of environment and disruption of social lives. The UAE is further benefitting from the League of Arab States to implement these risk reduction programs.

We conclude that the UAE has critical and non-critical partners in the risk management process. These include the League of Arab nations, various emergency and rescue agencies, the United Nation bodies, regional organizations, economic blocs, civil society, private entities and the mass media. Some of the important regional bodies include the Council of Arab Ministers Responsible for the Environment (CAMRE), the United Nations Secretariat for the International Strategy for Disaster Reduction (UNISDR), Technical Committees, International Federation for Red Cross Red Crescent Society, World Bank and Global Facility for Disaster Reduction and Recovery (GFDRR).

The ASDRR brings together various disaster risk management organizations such as the African Union⁵⁷⁸, the Asia-Pacific Economic Cooperation⁵⁷⁹, the Association of

⁵⁷⁷ *Hyogo Framework for Action*, 2005 – 2015.

South East Asian Nations⁵⁸⁰, and the Euro-Mediterranean Program for the Prevention, Preparedness and Response to Disasters (PPRD), the Organization of the Islamic Conference (OIC)⁵⁸¹ with the assistance of the United Nations, the World Bank, international development organizations and civil society”.

We find that the UAE has encountered various disasters, some emanating internally while others are from external sources. These disasters manifest in different ways including volcanic eruptions causing Tsunami, earthquakes, landslides, cyclones, floods, temperature extremes, famine, sand storms, fires, explosions among others. The 2007 Cyclone Gunu that covered all the way to Oman is one of the most memorable disasters that demonstrated why the UAE has to collaborate with multiple agencies to manage effects⁵⁸².

We further find that some environmental activities in the UAE over the decade are to blame for the rapid change in climate. Therefore, the country has experienced rising sea levels, floods, prolonged dry spells and increasing desertification⁵⁸³. The onus for the UAE is to ensure that the environmental risk management is in tandem with the rest of the Arab region strategy because some issues such as floods, earthquakes, landslides, sand storms and dry spell are not limited to national borders.

Consequently, a study in 2010 indicated that nearly 37 million people within the GCC were impacted by different risks and the mitigation cost the League of Arab nations over UD\$ 20 billion from 1980 – 2008 for natural disasters only. However, we find that if some of these risks were identified earlier and managed systematically, this cost would have been considerably lower. Specifically, this report has identified various primary and secondary issues and activities that contribute to the degradation of environment and

⁵⁷⁸ African Union/ NEPAD/ African Development Bank/ African Development Fund/ World Bank/ United Nations International Strategy for Disaster Reduction, *Africa Regional Strategy for Disaster Risk Reduction*, 2004

⁵⁷⁹ Asia-Pacific Economic Cooperation, *Strategy for Disaster Risk Reduction, Emergency Response and Preparedness in the Asia-Pacific region*, 2009 - 2015

⁵⁸⁰ Association of South East Asian Nations, *Agreement on Disaster Management and Emergency Response*, Vientiane, 26 July 2005

⁵⁸¹ Organization of the Islamic Conference, *Draft Strategy on Management of Disaster Risks and Climate Change Implications in the Islamic World*, 2010

⁵⁸² Arab Academy for Science, Technology and Maritime Transport, United Nations International Strategy for Disaster Reduction, World Bank, Workshop Summary Report, *Regional Workshop on disaster risk reduction and climate change*, Cairo 21-23 Nov 2009

⁵⁸³ UNDP, Arab Human Development Report Research paper series: *Mapping of climate change threats and human development impacts in the Arab region* 2010

socio-economic activities in the UAE. The primary issues include abrupt and unplanned urbanization, pollution, drought, internal and external migration altering demographics and change in conservation cultures of the Arab people. Additionally, there are secondary factors of risk concern, that are internal displacement of people during disasters, speed of response during epidemics, regular pandemic outbreaks, civil conflicts such as terror and associated threats and conflict of resources among other⁵⁸⁴.

This report has illustrated that UAE disasters are always occurring in familiar or new ways according to the evidence of the last two decades as an example. Whereas some disasters are long-term, others are short lived and this depends on the level of human awareness and national development to cope with the different challenges. The meeting in 2009 for Global Platform for Disaster Risk Reduction proposed that nations must adopt a multi-sector approach deal with the challenges and reduce impact timely⁵⁸⁵. We find that the UAE complied with this clarion call and has achieved rapid response to fight poverty because of disaster effects. The UAE has further outlined an elaborate strategy for combating climate change and assured the population that their welfare, rights and needs will be addressed within the framework of the Millennium Development Goals (MDGs)⁵⁸⁶.

We conclude that whereas some actors are involved directly in disaster management, others work in the background to coordinate activities and ensure linkages for relief of the affected persons or areas. Organizational innovation and resilience define the capacity of Abu Dhabi and UAE to mobilize and respond to every disaster⁵⁸⁷.

There are various critical actors in the Abu Dhabi disaster management process. Among these is the League of Arab States, whose role is offering leadership, support, resources, personnel and expertise for assessing situations. Additionally, the League of Arab States is committed to mobilizing other international actors to assist with humanitarian resources⁵⁸⁸.

⁵⁸⁴ *The Environment Outlook Report for the Arab Region*, 2010, Retrieved <http://eoar.cedare.int>

⁵⁸⁵ ISDR, *Global Assessment Report on Disaster Risk Reduction* 2009, Retrieved <http://www.preventionweb.net/english/hyogo/gar/report/index.php?id=9413>

⁵⁸⁶ 2009 Global Platform for Disaster Risk Reduction: Chair's Summary, Geneva, Switzerland Retrieved http://www.preventionweb.net/files/10750_GP09ChairsSummary.pdf

⁵⁸⁷ *The Arab Strategy for Disaster Risk Control* 2020, p. 18.

⁵⁸⁸ *The Arab Strategy for Disaster Risk Control* 2020, p. 19.

We find that various international organizations are instrumental in disaster management. These include World Health Organization, among others. These agencies are experts in various disaster relief and management aspects. Some of the roles include provision of temporary shelters for the homeless, food, healthcare and other safety support material. The agencies also train the public on how to avoid disaster situations including evacuation and recovery efforts. Moreover, the agencies have advanced strategies for communication with others and the population about the disaster status⁵⁸⁹.

We established that Abu Dhabi has regional centers for disaster management and risk reduction. These centers are useful for capacity building and knowledge dissemination among the population about potential disaster risks and ways of overcoming them. Additionally, the UAE has some national authorities involved in the actual disaster management operations. These authorities have national mandate and are required to give periodic reports on the countries state of disaster preparedness. Moreover, the authorities strive to work with communities and businesses to establish a safe environment including supporting legislative framework, policies, rules and regulations⁵⁹⁰.

Abu Dhabi has various civil society organizations, which are directly involved in disaster management and risk reduction. These include the International Red Cross Association, the Red Crescent and other non-profit community based organizations. These organizations are integrated under the ASDRR under the government oversight at regional, national and local levels. These organizations are tasked with coordinating disaster rescue and recovery efforts including provision of relief materials and other relevant assistances⁵⁹¹.

We conclude that the media in the UAE and specifically Abu Dhabi are very instrumental in the disaster management and risk reduction. Their roles include educating the masses about how to be responsible and avoid activities that can trigger non-natural disasters. Additionally, the media is useful in relaying information during the disaster recovery process so that harm and injury can be minimized significantly. The media is useful for creating awareness in disasters such as breakout of diseases, disruption of communication and transport flows, change in weather and other instances related to

⁵⁸⁹ Ibid

⁵⁹⁰ *The Arab Strategy for Disaster Risk Control 2020*, p. 19.

⁵⁹¹ Ibid.

local, regional or national disasters. The media is useful for debating how different organizations and agencies react to specific disaster events and plan continuous improvement in future⁵⁹².

Finally, Abu Dhabi is involved with numerous international organizations during disaster management and risk reduction process. These partners complement each other activities to ease the disaster stress and risk impact to the population and their property. Some of these partners are specialist in areas of disaster management and risk reduction for example in transport, housing, health, water and industrial sectors among others. Overall, the international partners are specialized in the following areas: “capacity development, trainings, knowledge management, risk assessments, integration of disaster risk reduction in the environment, health and education sectors, supporting the coordination and harmonization of disaster risk reduction tools at national and local levels, among others”⁵⁹³.

We find that the less critical actors in disaster governance include communal groups and teams whose intentions are findings ways of reducing risk at home or around their society. These include women, youth and men groups who have some economic or social agenda, but include disaster reduction and management as a key concern. The role of non-critical actors is important in grass root sensitization of risks, so that cost on disaster management can reduce significantly. Approximately 10% of relief funds support these non-critical actors in disaster management especially towards the post disaster occurrences. Additionally, the non-critical actors are useful for enforcing quality services during disaster management because they provide feedback on gaps or measures that need improvement in future⁵⁹⁴.

⁵⁹² Ibid.

⁵⁹³ *The Arab Strategy for Disaster Risk Control 2020*, p. 20.

⁵⁹⁴ *The Arab Strategy for Disaster Risk Control 2020*, p. 18.

Recommendations of New Innovations, which can Better Develop The UAE and Abu Dhabi Response to Disasters

This research established that in the last two decades, the Arab region has experienced more than 275 disasters, whereby more than 100,000 lost their lives, about 1.5 million internally displaced and another 10 million affected in some way. Specifically, the seismic activities have been most rampant in this region⁵⁹⁵. There are innovations, which can help UAE and Abu Dhabi improve the response to different disasters, as illustrated below:

- Define how the UAE and Abu Dhabi government are engaged in inclusive disaster management and risk reduction approach in all places.

The UAE must widen the partnership of bodies of risk reduction starting with the national policy framework, review of existing strategies and legal support so that all gaps are eliminated, going forward. The current risk management policies require in-depth assurance in areas like poverty reduction and supporting multi-national diversity created by the international migrants in urban areas. Moreover, the existing policies require proactive awareness campaigns and regular information to the public to know what to do whenever different types of disasters occur in the UAE. The new policy must address issues of demographic vulnerability especially the children and women whenever certain disasters occur and the priority to be given accordingly. Even though there are specialized emergency bodies activated whenever there is disease outbreak or public health concerns, there is need to innovate faster ways of communicating with the people and sending regular updates. Perhaps, with the penetration of mobile phones, could supplement the radios and other modes of mass communication to report and react to cases⁵⁹⁶.

The UAE and Abu Dhabi leadership needs to innovate ways of communicating climate change and impact to the public so that their subsequent calls for better environmental conservation can embrace with minimal resources. Additional resources must back the current state of using satellite to monitor the climate change so that all the environmental partners can be informed of the priorities for risk management and

⁵⁹⁵ EM-DAT <http://www.emdat.be/database>

⁵⁹⁶ *The Arab Strategy for Disaster Risk Reduction 2020*, p. 15.

reduction. Moreover, the UAE must innovate ways of decentralizing the information by including the population if regular updates on issues, responsibilities and timetable of implementation. Currently, the UAE and Abu Dhabi government have some sort of narrow information and data stream that may be counterproductive during emergence of new forms of disasters. If the UAE and Abu Dhabi can innovate a common platform where all the disaster management and reduction agencies can access information to supplement the current alarm / siren/ telephone call system, then the response time can greatly improve. The current system can lead to some interagency conflicts as was indicated by duplication of roles during flooding events in parts of UAE⁵⁹⁷.

- Innovate capacity for identifying, evaluating and tracking different disaster risks

The UAE and Abu Dhabi must innovate new risk assessment strategies that cover the national and regional details because risks vary geographically. Specifically, the trends in migration to the urban areas with more job opportunities have implication that new risk will emerge in due course and must mitigate timely before problems escalate to wider areas⁵⁹⁸. Therefore, the UAE should innovate a new network for information of past, current and future hazards and their likelihood of causing harm to the public at local, national and regional scope. A review of the HFA is a plausible starting point for this exercise. Moreover, such an innovation should combine risks and their likelihood to impact demographically⁵⁹⁹.

The UAE and Abu Dhabi need to mobilize the public understanding of different disasters so that they may collectively participate in the assessment process and reporting of likely events. Such an innovation will also save the government resources because proactive information will be coming from the ground. Therefore, implementation of the risk reduction strategies will have a high buy-in by the population. This strategy is more progressive in areas like managing risks of global warming and drought because the population on the ground will be informed on what to do timely. The UAE needs to innovate on better early warning approaches given that some disasters have primary and secondary hazards. Previously, the respective agencies have been focusing on the primary

⁵⁹⁷ *The Arab Strategy for Disaster Risk Reduction 2020*, p. 15.

⁵⁹⁸ *Ibid.*

⁵⁹⁹ *The Arab Strategy for Disaster Risk Reduction 2020*, p. 16.

problems, oblivious of the escalations in future. Additionally, the UAE and Abu Dhabi need an innovation of roster of all the past disaster, their management, the outcomes and their likelihood of recurrent so that new generations of population can be aware of appropriate action⁶⁰⁰.

- Innovate a knowledge database that will mobilize resilient public, support civil advocacy and teach on risk management and reduction strategies.

The UAE and Abu Dhabi government require a database, which is accessible to members of the public as long as they are of primary literacy level. Such a database can update information real time on the national, regional and international risk status and their vulnerabilities of the UAE population. Moreover, since Abu Dhabi has millions of international expatriates and migrants, such a database should be in the leading international languages to ease understanding and communication of contents. The database should also have additional educative materials and conference papers that the public can access to gain additional knowledge on disaster risks. Furthermore, organizations doing emergency drills should have an interface to inform the public of their intentions and the outcomes so that public confidence can build on disaster preparedness⁶⁰¹.

UAE and Abu Dhabi need to integrate training opportunities at community, institutional or organizational levels to improve individual and group skills in handling different types of disasters. After each successive training session, the respective emergency and rescue agencies need to recruit volunteers to lead disaster risk and management process during any events. Such volunteer initiatives must have gender balance and include women. In order to strengthen the disaster risk management and reduction, the UAE and Abu Dhabi need to streamline resources and information so that the actions have scientific backing. The resources need short, medium and long-term structures to avoid wastage or scarcity when the actual time for disaster management comes calling. Overall, the UAE and Abu Dhabi need a standard platform for communicating the internationally acceptable risk indicators and observing trends so that

⁶⁰⁰ *The Arab Strategy for Disaster Risk Reduction 2020*, p. 16.

⁶⁰¹ Ibid.

fewer resources are utilized eventually in prevention and reduction than actual mitigation⁶⁰².

- Innovate more accountable ways for disaster risk reduction and management at all levels of government

The UAE and Abu Dhabi in particular need to review the national, regional, local and traditional disaster accountability framework. There is need to assure the public that the existing disaster accountability systems are operationally sound, cost effective and managed by dedicated and reliable personnel. Previously, there has been a ministerial or organizational style of disaster accountability. However, these units need to be re-innovated to be more responsive and economical without compromising critical information. Some of the Ministries or sectors that need to be included in the disaster accountability framework include Tourism, Marine, Agriculture, Transport, Finance, Communication, Health and others critical to the economic growth. Moreover, the UAE and Abu Dhabi government need to review the legislative and legal accountability for disasters because some have serious effects on new or ongoing projects such as multi-billion worth of infrastructure⁶⁰³.

All quantity and quality planners, surveyors and contractors need a reviewed accountability for disasters, for example for landslides next to major roads, railways or airport because of the work at these sites. The essence of such a review is to ensure that populations are safe from harm, injury or deaths if the responsible experts or oversight bodies enforce specific codes. The ability to study current and future financial frameworks for projects can reveal whether there is sufficient insurance during disasters while the project is ongoing or much later after commissioning to use. Therefore, the UAE and Abu Dhabi government need to innovate a new risk transfer framework, which cushions the public resources from mitigation costs. Overall, any new risk accountability strategy must cover ongoing and completed projects including the rehabilitation steps post disaster⁶⁰⁴.

⁶⁰² *The Arab Strategy for Disaster Risk Reduction 2020*, p. 16.

⁶⁰³ *The Arab Strategy for Disaster Risk Reduction 2020*, p. 17.

⁶⁰⁴ Ibid.

- Innovate disaster preparedness and response and recovery to risks

The UAE and Abu Dhabi need to innovate ways of responding to the natural and non-natural disasters. Previously, there has been an alarm, siren and radio system of communication. However, this can have challenges to members of the public who have various disabilities, whether audio, visual, mobility or a combination of sorts, internally displaced persons and those with special needs. There is urgent need to review the existing policy so that different disaster management institutions can be effective in addressing every new challenge or diversity of old. Whereas the individual institutions have a disaster preparedness framework, there are differences on the way the public is engaged, especially the women and children, yet they too can be instrumental in risk reduction and management⁶⁰⁵.

The UAE and Abu Dhabi must innovate to modernize healthcare support that can cope with all forms of disasters. Previous experience especially during flooding and earthquake shows that the medical facilities were over stretched or had coordination gaps. Moreover, whereas most of the healthcare facilities are more prepared for physical injuries, the Abu Dhabi government must do more to staff them with psychosocial counselors and medical personnel since most people often suffer trauma and depression post disaster. Annually, the UAE and Abu Dhabi need to increase the financial budgets for compensating or assisting victims of different types of disasters so that they can get back to productive life within the shortest time⁶⁰⁶.

The UAE should ensure that the national and regional emergency procedures are operational and the staff share experiences and challenges so that services can improve over time. There is need for a forum to review each disaster or emergency operations to ascertain issues like response time and agency effectiveness. Moreover, the UAE needs to have a credible service quality evaluation system, whether national or international based. Some of the reliable quality benchmarks are SPHERE and IASC guidelines. The UAE needs to build capacity of disaster preparedness by aligning to university or regional institutions. Among the mandatory trainings required are capacity to evaluate damage and loss of lives. In order to improve the general disaster response in UAE and Abu Dhabi,

⁶⁰⁵ *The Arab Strategy for Disaster Risk Reduction 2020*, p. 17.

⁶⁰⁶ Ibid

there are opportunities for training personnel and capacity building at the Regional Centre for Disaster Risk Reduction Training and Research (RCDRR), established in Cairo. Finally, the UAE needs to innovate a framework for addressing international disasters that starts in a neighboring nation and threatens others. The aim of such a caucus is coordinate response teams, improve preparations and shorten the recovery time⁶⁰⁷.

Strengths and Weaknesses of the UAE and Abu Dhabi Disaster Response System

The UAE has reacted to the rising statistics of disasters by entrenching various frameworks and treaties. These include Millennium Development Goals (MDGs); the *Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters* at the World Conference on Disaster Reduction held in Kobe, Japan 2005 among others. Other organizations that have active role in the disaster response in the UAE include the LAS such as the Arab Academy for Science, Technology and Maritime Transport (AASTMT), the Arab Centre for the Study of Arid Zones and Dry Lands (ACSAD). Additionally, the Arab Organization for Agricultural Development (AOAD), the Arab Labor Organization (ALO) and the Arab League's Educational, Cultural and Scientific Organization (ALECSO) have been very conspicuous lately⁶⁰⁸. However, the UAE has certain strengths and weaknesses as the government seeks to identify risks and implement the management steps under a multi sector approach to minimize related risks.

- Strengths

We find that the UAE has a role in strengthening the socio-economic welfare of its people by leading in the implementation of various strategies aiming at risk reduction. Since the UAE allows internal and external partnership, this as strength because they complement each other's capacities and ensure the country is resilient in tackling fresh disasters. Whenever such synergies are drawn, the UAE has better utilization of emergency and rescue resources during disaster management process. Moreover, the inter agency approach is a strength for the UAE because the nation stands united during trying moments and there is social cohesion. The utilization of different organizations in UAE

⁶⁰⁷ Ibid.

⁶⁰⁸ *The Arab Strategy for Disaster Risk Reduction 2020*, p. 7.

risk reduction and management provides the best technical skills, as there is specialization of roles and better spread of resources. Additionally, the inter agency approach is more effective for risk monitoring, evaluation and mitigation process.

- Weaknesses

Among of the key weakness of UAE and Abu Dhabi in disaster risk management is inability to tackle some secondary effects of the natural and non-natural disasters. This report has showed that there are instances when the designated emergency agencies are inadequate in managing the seismic events, pollution and degradation, protecting endangered species, water availability and distribution. Other weaknesses of the UAE and Abu Dhabi include inadequate capacity to mitigate global warming effects, predict cyclones and communicate their impacts, construct dykes and walls near dams to prevent flooding and stop poor land use leading to rapid desertification⁶⁰⁹.

Due to these weaknesses, the UAE and Abu Dhabi population have experienced systematic or abrupt secondary risks. These include rapid depletion of food and water resources in the urban and rural regions, disruption in the demographics as more international migrants come to fill the labor opportunities, Similarly, there have been springing of new unplanned settlement schemes yet these could be lying on landslide regions and expose the residents to future risks. The rapid international migrations to the UAE are causing serious transport and communication challenges to the country's existing infrastructure, which has forced the government to carry out several upgrades regularly⁶¹⁰.

The UAE and Abu Dhabi has some civilian governance problems due to the rapid increase in population and local have some tension with the expatriates for taking up their opportunities. The social amenities are either crowded or overstretched in the UAE and Abu Dhabi. These include medical facilities and there is fear that disease outbreak could affect very many people in the densely populated areas. Specifically, Abu Dhabi has been grasping with the public health issues over the last decade as more people move to the area⁶¹¹.

⁶⁰⁹ *The Arab Strategy for Disaster Risk Reduction 2020*, p. 9.

⁶¹⁰ Ibid.

⁶¹¹ Ibid.

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Appendix A: Research Process Plan

[illegible]

Appendix B: UAE Governance Structures

Supreme Council Members

H.H. President Sheikh Khalifa bin Zayed Al Nahyan, Ruler of Abu Dhabi

H.H. Vice President and Prime Minister Sheikh Mohammed bin Rashid Al Maktoum, Ruler of Dubai

H.H. Dr Sheikh Sultan bin Mohammed Al Qasimi, Ruler of Sharjah

H.H. Sheikh Saud bin Saqr Al Qasimi, Ruler of Ra's al-Khaimah

H.H. Sheikh Hamad bin Mohammed Al Sharqi, Ruler of Fujairah

H.H. Sheikh Saud bin Rashid Al Mu'alla, Ruler of Umm al-Qaiwain

H.H. Sheikh Humaid bin Rashid Al Nuaimi, Ruler of Ajman

Crown Princes

H.H. General Sheikh Mohamed bin Zayed Al Nahyan, Crown Prince of Abu Dhabi and Deputy Supreme Commander of the UAE Armed Forces

H.H. Sheikh Hamdan bin Mohammed Al Maktoum, Crown Prince of Dubai

H.H. Sheikh Sultan bin Mohammed Al Qasimi, Crown Prince and Deputy Ruler of Sharjah, Chairman of the Sharjah Executive Council

H.H. Sheikh Mohammed bin Saud bin Saqr Al Qasimi, Crown Prince of Ra's al Khaimah

H.H. Sheikh Mohammed bin Hamad Al Sharqi, Crown Prince of Fujairah

H.H. Sheikh Rashid bin Saud bin Rashid Al Mu'alla, Crown Prince of Umm al-Qaiwain

H.H. Sheikh Ammar bin Humaid Al Nuaimi, Crown Prince of Ajman

Deputy Rulers

H.H. Sheikh Hamdan bin Rashid Al Maktoum, Deputy Ruler of Dubai, Minister of Finance and Industry

H.H. Sheikh Maktoum bin Mohammed Al Maktoum, Deputy Ruler of Dubai

H.H. Sheikh Ahmed bin Sultan Al Qasimi, Deputy Ruler of Sharjah

H.H. Sheikh Abdulla bin Salem bin Sultan Al Qasimi, Deputy Ruler of Sharjah

H.H. Sheikh Hamad bin Saif Al Sharqi, Deputy Ruler of Fujairah

H.H. Sheikh Abdullah bin Rashid Al Mu'alla, Deputy Ruler of Umm al-Qaiwain

H.H. Sheikh Nasser bin Rashid Al Nuaimi, Deputy Ruler of Ajman

Members of the Cabinet

Prime Minister and Minister of Defence: Vice President H.H. Sheikh Mohammed bin Rashid Al Maktoum

Deputy Prime Minister and Minister of Interior: H.H. Lt Gen. Sheikh Saif bin Zayed Al Nahyan

Deputy Prime Minister and Minister of Presidential Affairs : H.H. Sheikh Mansour bin Zayed Al Nahyan

Minister of Finance: H.H. Sheikh Hamdan bin Rashid Al Maktoum

Minister of Foreign Affairs and Chairman of the National Media Council: H.H. Sheikh Abdullah bin Zayed Al Nahyan

Minister of Culture, Yourth and Community Development: Sheikh Nahyan bin Mubarak Al Nahyan

Minister of Higher Education and Scientific Research: Sheikh Hamdan bin Mubarak Al Nahyan

Minister of Development and International Cooperation: Sheikha Lubna bint Khalid Al Qasimi

Minister of Cabinet Affairs: Mohammad Abdullah Al Gargawi

Minister of Economy: Sultan bin Saeed Al Mansouri

Minister of Social Affairs: Maryam Al Roumi

Minister of Education: Humaid Mohammed Obaid Al Qattami

Minister of Health: Abdul Rahman bin Mohammad Al Owais

Minister of Labour: Saqr Ghobash Saeed Ghobash

Minister of Energy: Suhail bin Mohamed Faraj Fares Al Mazrouei

Minister of Justice: Dr Hadeef bin Juaan Al Dhahiri

Minister of Environment and Water: Dr Rashid Ahmed bin Fahad

Minister of Public Works: Abdullah bin Mohamed Belhaif Al Nuaimi

Minister of State for Foreign Affairs and Minister of State for FNC Affairs: Dr Mohammed Anwar Gargash

Minister of State for Financial Affairs: Obaid Humaid Al Tayer

Minister of State: Dr Maitha Salem Al Shamsi

Minister of State: Reem Ibrahim Al Hashimi

Minister of State: Dr Sultan bin Ahmed Sultan Al Jaber

Minister of State: Abdullah bin Mohammed Ghobash

Secretary General of the Federal Supreme Council: Hamad Abdul Rehman Al Medfa'

Federal National Council (FNC)

The FNC is the UAE's advisory council, comprising 40 members – eight from Abu Dhabi and Dubai; six from Sharjah and Ra's al-Khaimah; and four from Ajman, Umm al-Qaiwain and Fujairah.

The FNC's functions include:

- Discussing constitutional amendments and draft laws, which may be approved, amended or rejected
- Reviewing the annual draft budget of the Federation
- Debating international treaties and conventions
- Influencing the Government's work through the channels of discussion, question and answer sessions, recommendations and following up on complaints.

Appendix C: The Seven Principles that Steer the UAE Governance

- Enhance the role of federal entities in devising effective regulations and integrated policies by successful planning and enforcement.
- Enhance effective coordination and cooperation among federal entities and with local governments.
- Focus on delivering high-quality, customer-centric and integrated government services
- Invest in human resource capabilities and develop leaders.
- Promote efficient resource management within federal entities and leverage dynamic partnerships.
- Pursue a culture of excellence through strategic thinking, continuous performance improvement and superior results.
- Enhance transparency and accountable governance mechanisms throughout the federal entities.

Appendix D: Abu Dhabi risk analysis questionnaire based in the Hyogo Framework for Action (HFA)

Abu Dhabi progress report on the implementation of the Hyogo Framework for Action

(First Cycle)

Priority for Action 1:

Ensure that disaster reduction is a national and local priority with a strong institutional basis for implementation

Core Indicator 1.1

National policy and legal framework for disaster risk reduction exists with decentralized responsibilities and capacities at all levels.

How well are local organizations (including local government) equipped with capacities (knowledge, experience, official mandate) for disaster risk reduction and climate change adaptation?

Level of Progress achieved:

Description of Progress & Achievements

To what extent do partnerships exist between communities, private sector and local authorities to reduce risk?

Level of Progress achieved:

Description of Progress & Achievements:

Core Indicator 1.2

Dedicated and adequate resources are available to implement disaster risk reduction plans and activities at all administrative levels.

How far does the local government have access to adequate financial resources to carry out risk reduction activities?

Level of Progress achieved:

Description of Progress & Achievements:

To what degree does the local government allocate sufficient financial resources to carry out DRR activities, including effective disaster response and recovery?

Level of Progress achieved:

Description of Progress & Achievements:

Core Indicator 1.3

Community participation and decentralization are ensured through the delegation of authority and resources to local levels.

How much does the local government support vulnerable local communities (particularly women, elderly, infirmed, children) to actively participate in risk reduction decision-making, policy making, planning and implementation processes?

Level of Progress achieved:

Description of Progress & Achievements:

To what extent does the local government provide training in risk reduction for local officials and community leaders?

Level of Progress achieved:

Description of Progress & Achievements:

How regularly does the local government conduct awareness building or education programs on DRR and disaster preparedness for local communities?

Level of Progress achieved:

Description of Progress & Achievements:

Core Indicator 1.4

A national multi-sectorial platform for disaster risk reduction is functioning.

To what extent does the local government participate in the national DRR planning?

Level of Progress achieved:

Description of Progress & Achievements:

Priority for Action 2

Identify, assess and monitor disaster risks and enhance early warning

Core Indicator 2.1

National and local risk assessments based on hazard data and vulnerability information are available and include risk.

To what degree does the local government conducted thorough disaster risk assessments for key vulnerable development sectors in your local authority?

Level of Progress achieved:

Description of Progress & Achievements:

To what extent are these risk assessments regularly updated, e.g. annually or on a bi-annual basis?

Level of Progress achieved:

Description of Progress & Achievements:

How well are disaster risk assessments incorporated into all relevant local development planning on a consistent basis?

Level of Progress achieved:

Description of Progress & Achievements:

To what extent have local schools, hospitals and health facilities received special attention for "all hazard" risk assessments in your local authority?

Level of Progress achieved:

Description of Progress & Achievements:

How safe are all main schools, hospitals and health facilities from disasters so that they have the ability to remain operational during emergencies?

Level of Progress achieved:

Description of Progress & Achievements:

Core Indicator 2.2

Systems are in place to monitor, archive and disseminate data on key hazards and Vulnerabilities

What systems are in place?

Level of Progress:

Description of Progress & Achievement:

Core Indicator 2.3

Early warning systems are in place for all major hazards, with outreach to communities.

To what extent are early warning centers established, adequately staffed (or on-call personnel) and well resourced (power backups, equipment redundancy etc.) at all times?

Level of Progress achieved:

Description of Progress & Achievements:

How much do warning systems allow for adequate community participation?

Level of Progress achieved:

Description of Progress & Achievements:

Core Indicator 2.4

National and local risk assessments take account of regional/trans-boundary risks, with a view to regional cooperation on risk reduction.

How well are local government risk assessments linked to, and supportive of, risk assessments from neighboring local authorities and state or provincial government risk management plans?

Level of Progress achieved:

Description of Progress & Achievements:

Priority for Action 3

Use knowledge, innovation and education to build a culture of safety and resilience at all levels

Core Indicator 3.1

Relevant information on disasters is available and accessible at all levels, to all stakeholders (through networks, development of information sharing systems, etc.).

How regularly does the local government communicate to the community, information on local hazard trends and risk reduction measures (e.g. using a Risk Communications Plan) including early warnings of likely hazard impact?

Level of Progress achieved:

Description of Progress & Achievements:

Core Indicator 3.2

School curricula, education material and relevant trainings include disaster risk reduction and recovery concepts and practices.

To what degree do local schools and colleges include courses, education or training in disaster risk reduction (including climate related risks) as part of the education curriculum?

Level of Progress achieved:

Description of Progress & Achievements:

Core Indicator 3.3

Research methods and tools for multi-risk assessments and cost benefit analysis are developed and strengthened.

Is there a specific methodology for risk assessment and cost benefit analysis in Abu Dhabi?

Level of Progress achieved:

Description of Progress & Achievements:

Core Indicator 3.4

Countrywide public awareness strategy exists to stimulate a culture of disaster resilience, with outreach to urban and rural communities.

Is Abu Dhabi having a culture of disaster resilience for all?

Level of Progress achieved:

Description of Progress & Achievements:

Priority for Action 4

Reduce the underlying risk factors

Core Indicator 4.1

Disaster risk reduction is an integral objective of environment related policies and plans, including for land use, natural resource management and adaptation to climate change.

How well integrated are local government DRR policies, strategies and implementation plans with existing environmental development and natural resource management plans?

Level of Progress achieved:

Description of Progress & Achievements:

How far do land use policies and planning regulations for housing and development infrastructure consider current and projected disaster risk (including climate related risks)?

Level of Progress achieved:

Description of Progress & Achievements:

How well are risk-sensitive land use regulations and building codes, health and safety codes enforced across all development zones and building types?

Level of Progress achieved:

Description of Progress & Achievements:

How strong are existing regulations (e.g. land use plans, building codes etc) to support disaster risk reduction in your local authority?

Level of Progress achieved:

Description of Progress & Achievements:

To what degree does the local government support the restoration, protection and sustainable management of ecosystems services?

Level of Progress achieved:

Description of Progress & Achievements:

How much do civil society organizations and citizens participate in the restoration, protection and sustainable management of ecosystems services?

Level of Progress achieved:

Description of Progress & Achievements:

How much does the private sector participate in the implementation of environmental and ecosystems management plans in your local authority?

Level of Progress achieved:

Description of Progress & Achievements:

Core Indicator 4.2

Social development policies and plans are being implemented to reduce the vulnerability of populations most at risk.

What is the scope of financial services (e.g. saving and credit schemes, macro and micro-insurance) available to vulnerable and marginalized households for pre- disaster times?

Level of Progress achieved:

Description of Progress & Achievements:

To what extent are micro finance, cash aid, soft loans, and loan guarantees etc. available to affected households after disasters to restart livelihoods?

Level of Progress achieved:

Description of Progress & Achievements:

Core Indicator 4.3

Economic and productive sectorial policies and plans have been implemented to reduce the vulnerability of economic activities.

How well established are economic incentives for investing in disaster risk reduction for households and businesses (e.g. reduced insurance premiums for households, tax holidays for businesses)?

Level of Progress achieved:

Description of Progress & Achievements:

To what extent do local business associations, such as chambers of commerce and similar, support efforts of small enterprises for business continuity during and after disasters?

Level of Progress achieved:

Description of Progress & Achievements:

Core Indicator 4.4

Planning and management of human settlements incorporate disaster risk reduction elements, including enforcement of building codes.

How adequately are critical public facilities and infrastructure located in high-risk areas assessed for all hazard risks and safety?

Level of Progress achieved:

Description of Progress & Achievements:

How adequate are the measures that are being undertaken to protect critical public facilities and infrastructure from damage during disasters?

Level of Progress achieved:

Description of Progress & Achievements:

Core Indicator 4.5

Disaster risk reduction measures are integrated into post disaster recovery and rehabilitation processes.

How well disaster risk reduction measures are integrated into post disaster recovery and rehabilitation activities (i.e. build back better, livelihoods rehabilitation)?

Level of Progress achieved:

Description of Progress & Achievements:

Core Indicator 4.6

Procedures are in place to assess the disaster risk impacts of major development projects, especially infrastructure

To what degree do local government or other levels of government have special programs in place to regularly assess schools, hospitals and health facilities for maintenance, compliance with building codes, general safety, weather-related risks etc.?

Level of Progress achieved:

Description of Progress & Achievements:

Priority for Action 5

Strengthen disaster preparedness for effective response at all levels

Core Indicator 5.1

Strong policy, technical and institutional capacities and mechanisms for disaster risk management, with a disaster risk reduction perspective are in place.

Does Abu Dhabi have a strong policy monitoring disaster risk reduction?

Level of Progress achieved:

Description of Progress & Achievements:

Core Indicator 5.2

Disaster preparedness plans and contingency plans are in place at all administrative levels, and regular training drills and rehearsals are held to test and develop disaster response programs.

How regularly are training drills and rehearsal carried out with the participation of relevant government, non-governmental, local leaders and volunteers?

Level of Progress achieved:

Description of Progress & Achievements:

How available are key resources for effective response, such as emergency supplies, emergency shelters, identified evacuation routes and contingency plans at all times?

Level of Progress achieved:

Description of Progress & Achievements:

To what extent does the local government have an emergency operations Centre (EOC) and/or an emergency communication system?

Level of Progress achieved:

Description of Progress & Achievements:

How aware are citizens of evacuation plans or drills for evacuations when necessary?

Level of Progress achieved:

Description of Progress & Achievements:

To what degree does the Contingency Plan (or similar plan) include an outline strategy for post disaster recovery and reconstruction, including needs assessments and livelihoods rehabilitation?

Level of Progress achieved:

Description of Progress & Achievements:

How far are regular disaster preparedness drills undertaken in schools, hospitals and health facilities?

Level of Progress achieved:

Description of Progress & Achievements:

Core Indicator 5.3

Financial reserves and contingency mechanisms are in place to support effective response and recovery when required.

To what degree do local institutions have access to financial reserves to support effective disaster response and early recovery?

Level of Progress achieved:

Description of Progress & Achievements:

How much access does the local government have to resources and expertise to assist victims of psycho-social (psychological, emotional) impacts of disasters?

Level of Progress achieved:

Description of Progress & Achievements:

Core Indicator 5.4

Procedures are in place to exchange relevant information during hazard events and disasters, and to undertake post-event reviews.

Does Abu Dhabi have a platform for exchanging information during disaster events all the way to end of operations?

Level of Progress achieved:

Description of Progress & Achievements:

Appendix E: Semi Structure Interview Questions

The following were involved in the interviews: UN Disaster Management Teams, National Disaster Management Coordinator and NGO heads

1. How are lightening disasters minimized or eliminated in Abu Dhabi and UEA in general?
2. What risks are posed by floods and what are the mechanisms deployed to mitigate such disasters?
3. What should the public do once they receive alerts and signals of earthquake or tremors?
4. How should the public be on the lookout for Tsunamis?
5. What signs of landslide should the public look out for to prepare for related disasters?
6. What should the public do or not do during power outage disasters?
7. What is expected of the public during wars?
8. Which Chemical attacks should the public be on the lookout and what action should they take?
9. What action should the public take during biological germ disasters?
10. How can the public limit fire incidences and associated disasters?
11. What action should respective authorities take during a radioactive leakage event?

Appendix F: Survey Questionnaire

1. What is your gender? [A] Male [B] Female
2. What is your age bracket? [A] 18-25 years [B] 26-35 years [C] 36 – 45 years [D] 46 – 55 years [E] 56 – 65 years [F] Over 65 years
3. What is your occupational status? [A] Employed [B] Unemployed [C] Student [D] Other
4. If employed how much experience do you have in the current experience? [A] Less than 2 years [B] 2 – 5 years [C] 6 – 10 years [D] 11 – 15 years [F] Over 15 years
5. What is your area of occupation? [A] Education [B] Health Care [C] Farming [D] Housing & Real Estate [E] Manufacturing / Processing [F] Survey / Land Economics [G] Transport [H] Communication [I] Science & Technology [J] Building and Construction / Engineering [K] Energy – Oil, Gas, Electricity, Wind, Solar, [L] Water Services [M] Textile Industry [N] Government Services [O] Others services
6. What is your view on the following statements about Abu Dhabi Disaster Risk Management and Reduction? Please tick the most appropriate option.

Response Stage	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Abu Dhabi's disaster prevention mechanism is satisfactory					
Abu Dhabi's disaster mitigation mechanism is satisfactory					
Abu Dhabi's disaster preparedness is satisfactory					
Abu Dhabi's disaster response mechanism is satisfactory					
Abu Dhabi's disaster recovery mechanism is satisfactory					

7. Natural Disaster Risk Management

Response Stage	Least Prepared [1]	[2]	[3]	[4]	Most Prepared [5]
Abu Dhabi's disaster management of risks associated with landslides, liquefaction and slope failure is					
Abu Dhabi's disaster management of risks associated with extreme climatic activity is					
Abu Dhabi's disaster management of risks associated with extreme heat is					
Abu Dhabi's disaster management of risks associated with flash floods is					
Abu Dhabi's disaster management of risks associated with flooding from the sea waves is					
Abu Dhabi Management of risks associated with Tsunamis due to tectonic activities is					
Abu Dhabi management of risks associated with earthquakes from tectonic activities is					

8. Non-Natural Disaster Risk Management

Response Stage	Least Prepared [1]	[2]	[3]	[4]	Most Prepared [5]
Abu Dhabi's disaster management of risks associated with health and safety is					
Abu Dhabi's disaster management of risks associated with chemical spillages and radioactive material is					
Abu Dhabi's disaster management of risks associated with terrorism is					
Abu Dhabi's disaster management of risks associated fire incidences is					
Abu Dhabi's disaster management of risks associated car or air accidents is					
Abu Dhabi Management of risks associated with infrastructural construction is					
Abu Dhabi management of risks associated with industrial explosions is					

9. Why has there been increased awareness of disaster risks in the last decade?

Response Stage	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Improved government legislation at Federal and State Level					
Better public awareness and lobbying NGOs and Civil Society					
Detailed Company Policies					
More opportunities for occupational training and skills impact for employee competence					
Access to more scientific data of the disaster phenomenon					
Better interpretation of information due to availability of translated materials in Arabic.					
Access for financial resources					
Government pressure					

10. Natural Disaster Management Capacity in Abu Dhabi, UAE.

Response Stage	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
In the Abu Dhabi efforts to minimize impact of natural disasters the government is able to provide immediate assistance to maintain life					
In the Abu Dhabi efforts to minimize impact of natural disasters the government is able to search and rescue people and even provide emergency relief					
In the Abu Dhabi efforts to minimize impact of natural disasters the government is able to improve health and support all the affected persons					
In the Abu Dhabi efforts to minimize impact of natural disasters the government is able to initiate initial repairs to damaged infrastructure					

Recovery Stage	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
In Abu Dhabi government efforts to return the community to normal, there is provision of temporary housing					
In Abu Dhabi government efforts to return the community to normal, there are grants and subsidies					
In Abu Dhabi government efforts to return the community to normal, there is medical care					
In Abu Dhabi government efforts to return the community to normal, there is restoring of lives					

Mitigation Stage	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
In Abu Dhabi government efforts to minimize effects of natural disasters there is public education					
In Abu Dhabi government efforts to minimize effects of natural disasters there are building safety codes					
In Abu Dhabi government efforts to minimize effects of natural disasters there are vulnerability analyses updates					
In Abu Dhabi government efforts to minimize effects of natural disasters there is zoning and land use management					

Preparedness Stage	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
In Abu Dhabi government efforts of planning how to respond to natural disasters there are developed strategies					
In Abu Dhabi government efforts of planning how to respond to natural disasters there are preparedness plans					
In Abu Dhabi government efforts of planning how to respond to natural disasters there are trainings and scenario simulations or drills					
In Abu Dhabi government efforts of planning how to respond to natural					

disasters there are warning and alert systems					

11. Non-natural disaster management capacity in Abu Dhabi, UAE

Non- natural disaster prevention, recovery and reconstruction Model	Least Prepared [1]	[2]	[3]	[4]	Most Prepared [5]
Social relations and structure of domains that improve social protection of household livelihoods					
Unsafe conditions					
Specific Hazards					
Time, space and nature of hazards					
Social relations or structures that trigger events					
Social protection to prevent transition to disaster					
Reaction, coping, adaptation, intervention, e.t.c to dynamic impact of disaster as a process					
Action for disaster reduction or prevention of next disaster					