

**T.C.
BAHÇEŞEHİR ÜNİVERSİTESİ**

**HUMAN BEHAVIOR WITH IOT AND SOCIAL MEDIA
FOR DISASTER MANAGEMENT**

Master's Thesis

MERYEM WALID AL-RAWI

ISTANBUL, 2020

THE REPUBLIC OF TURKEY
BAHÇEŞEHİR UNIVERSITY

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES
INFORMATION TECHNOLOGY

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DEDICATION

I would like to dedicate my thesis to the source of my hidden strength behind my every success.

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May God Almighty Allah Bless You All

ABSTRACT
HUMAN BEHAVIOR WITH IOT AND SOCIAL MEDIA FOR DISASTER
MANAGEMENT

Meryem Walid Al-Rawi

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Disasters whether "Natural" or "Man-made", have substantial impact on communities in terms of human behaviour aspect or material resources. Communications between governments, communities, and people involved in the management of disasters and their outcome are essential and mandatory for the purposes of early warning, rescue services during their occurrence, and recovery after passing over. Different communication ways including mobile phone, mobile message, social media web sites, etc. have been used for inter-changing data before, during and after disaster.

In this study, we explore how people from few countries, specifically, participants from Turkey and Iraq, may feel (or their past experience) about disaster, the social media they may use (or had used) during the disaster and whether there are advantages of using IoT and social media in disaster management. Furthermore the survey has included questions related to the internet, IoT, and social media sites and applications that would be using throughout the three phases of disaster (before, during, and after). Moreover, the current study investigated the emotional and psychological effects of the disaster (before, during, and after its occurrence) on human behavior.

Three hundred and fifty two persons, from both sexes, of different ages, and having various educational qualifications, have responded to the current study questionnaire. The survey analysis has shown quite different emotional and "psychological" attitudes of the participants to the event of disaster. There is a significant difference between the human behaviors before and after disaster occurrence. Furthermore, the assumption of correlation between using IoT technology and age levels has proved that new generations are more likely interested in using IoT technology than old generations. In addition, the survey has shown that while citizens in Iraq prefer to use Facebook application, during the disaster, however, citizens of Turkey prefer to use WhatsApp application for their communication. It has been concluded that applications of social media will aid in taking precautionary warning measures before disaster, aid in rescue operation during disaster, and further, assist in recovery after disasters.

Keywords: Disaster, Disaster Management, Social Media, Internet Of Things, Technology, Human Behavior.

ÖZET

AFET YÖNETİMİNDE İÇİN IOT VE SOSYAL MEDYADA İNSAN DAVRANIŞI

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“Doğal” ya da “İnsan Yapımı” afetlerin, materyal kaynaklar ve insanların davranışı açısından, topluluklar üzerinde önemli etkileri vardır. Hükümetler, topluluklar ve afetlerin yönetimine dahil olan insanlar arasındaki iletişim ve bu iletişimden elde edilen sonuçlar, erken uyarı, afetin meydana gelme sırasındaki kurtarma hizmetleri ve geçtikten sonra iyileşme için zorunludur. Afet öncesinde, sırasında ve sonrasında verileri değerlendirmek için mobil telefon, mobil mesaj, sosyal medya web siteleri ve benzeri farklı iletişim yolları kullanılmıştır.

Bu çalışmada, özellikle Türkiye ve Irak'tan katılımcı olan, birkaç ülkeden insanlara yönelip onların afet hakkında neler hissettiklerini (veya geçmiş deneyimlerini), afet sırasında kullanabilecekleri sosyal medyayı (veya daha önce kullandıkları) ve afet yönetiminde sosyal medyayı ve Nesnelerin İnterneti'ni kullanmanın herhangi bir avantajı olup olmadığını araştırıyoruz. Ayrıca anket; internet, Nesnelerin İnterneti ve sosyal medya siteleriyle ilgili soruları ve afetin üç aşaması boyunca (öncesinde, sırasında ve sonrasında) kullanabileceği uygulamaları da içermektedir. Dahası, bu çalışma afetin (ortaya çıkmadan önce, sırasında ve sonrasında) insan davranışları üzerindeki duygusal ve psikolojik etkilerini araştırmıştır. Her iki cinsiyetten, farklı yaş gruplarından ve çeşitli eğitsel niteliği olan üç yüz elli iki kişi bu çalışma anketini cevaplandırmıştır. Anket analizi afet durumuna karşı katılımcıların duygusal ve “psikolojik” tutumlarının oldukça farklı olduğunu göstermiştir. Afetin meydana gelmesinden öncesi ve sonrasında insan davranışlarının arasında belirgin farklar vardır. Dahası, Nesnelerin İnterneti teknolojisinin kullanımı ve yaş grupları arasındaki korelasyonunun varsayımı, yeni jenerasyonların Nesnelerin İnternet teknolojisini kullanmayla eski jenerasyonlardan daha muhtemel ilgilendiklerini kanıtlamıştır. Ek olarak, anket Irak'taki vatandaşlarının afet sırasında Facebook uygulamasını kullanmayı tercih ettiklerini, öteki yandan Türk vatandaşlarının iletişimleri için WhatsApp uygulamasını kullanmayı tercih ettiklerini göstermiştir. Sosyal medya uygulamalarının, afetten önce önleyici tedbir almada ve afet sırasında kurtarma operasyonunda yardımcı olacağı, dahası, afet sonrası iyileşmede destek olacağı sonucuna varılmıştır.

Anahtar Kelimeler: Afet, Afet Yönetimi, Sosyal Medya, İnterneti, Teknoloji, İnsan Davranışı.

CONTENTS

TABLES	xi
FIGURES	xviii
ABBREVIATIONS	xx
1. INTRODUCTION	1
1.1 PROBLEM STATEMENT	4
1.2 ASSUMPTIONS OF THE STUDY.....	4
1.3 MOTIVATION OF THE STUDY	6
1.4 ORGANIZATION OF THE THESIS	7
2. GENERAL BACKGROUND	9
2.1 INTERNET OF THINGS FOR DISASTER MANAGEMENT	9
2.2 SOCIAL MEDIA FOR DISASTER MANAGEMENT	14
2.3 HUMAN BEHAVIOR IN DISASTERS	20
3. DATA AND METHOD	24
3.1 INTRODUCTION	24
3.2 CONSIDERATIONS AND LIMITATIONS OF THE STUDY	24
3.3 RESEARCH APPROACH	25
3.4 THE SAMPLING METHOD AND SURVEY DESIGN	26
3.4.1 Sampling Method of the Research	26
3.4.2 Survey Design.....	27
3.5 DATA COLLECTION.....	28
3.6 DATA ANALYSIS	28
3.7 SURVEY QUESTIONS RESULTS	29
3.7.1 Personal Information of the Participants Tables.....	29
3.7.2 The IoT Results Tables.....	35
3.7.3 Social Media Results Parts.....	38

3.7.4 Human Behavior Questions Results Tables	48
4.8 NORMAL DISTRIBUTION TEST OF THE DATA.....	59
4.9 CONCEPTUAL FRAMEWORK AND HYPOTHESIS ANALYSIS	62
3.10 APPROVED RESULTS OF HYPOTHESIS	92
4. DISCUSSION	95
4.1 HUMAN BEHAVIOUR DISCUSSION	96
4.2 SOCIAL MEDIA DISCUSSION	101
4.3 INTERNET OF THINGS (IOT) DISCUSSION.....	106
5. CONCLUSION AND RECOMMENDATIONS.....	109
REFERENCES.....	112
APPENDICES	118
Appendix A.1 Survey Questions.....	119
CURRICULUM VITAE.....	126

TABLES

TABLE 3.1: CORRELATION RELATIONSHIP BETWEEN SCALES	29
TABLE 3.2: GENDER.....	29
TABLE 3.3: AGE GROUPS	30
TABLE 3.4: EDUCATIONAL LEVEL	30
TABLE 3.5: COUNTRY	31
TABLE 3.6: RESIDENCY	31
TABLE 3.7: TIME SPENDING ON SOCIAL MEDIA.....	32
TABLE 3.8: SINCE WHEN DID YOU START USING SOCIAL MEDIA?.....	32
TABLE 3.9: HAVE YOU EVER EXPERIENCED OR HAVE BEEN PART OF ANY KIND OF DISASTERS?.....	32
TABLE 3.10: IF YES, WHAT KIND OF NATURAL DISASTERS YOU HAVE EXPERIENCED?	33
TABLE 3.11: IF YES, WHAT KIND OF MAN-MADE DISASTERS YOU HAVE EXPERIENCED? ..	34
TABLE 3.12: DID YOU TAKE ANY DISASTER MANAGEMENT PROGRAM IN YOUR SCHOOL, COLLEGE OR OFFICE?.....	35
TABLE 3.13: IS THE INTERNET SERVICE AVAILABLE EFFICIENTLY AND CONTINUOUSLY ON YOUR COUNTRY?	35
TABLE 3.14: IS INFRASTRUCTURE FOR IoT IS AVAILABLE IN YOUR CITY?	36
TABLE 3.15: DO YOU USE INTERNET NETWORK TO LEARN ABOUT WEATHER NEWS AND CONDITIONS?.....	36
TABLE 3.16: IoT CREATES POSITIVE ATTITUDES TO REDUCE DISASTER CONSEQUENCE? ..	36
TABLE 3.17: IoT SENSORS MAY BE HAVING NEGATIVE EFFECT ON PEOPLE HEALTH?	37
TABLE 3.18: IoT INCREASES PRODUCTIVITY OF SOCIAL MEDIA?	37
TABLE 3.19: ARE YOU GOING TO USE IoT TECHNOLOGY TO CONTROL YOUR HOME EQUIPMENT?.....	37
TABLE 3.20: WHICH TYPE OF MOBILE APPLICATIONS WOULD YOU FAVOR TO USE TO COMMUNICATE WITH YOUR RELATIVES OR FRIENDS FREQUENTLY?.....	38
TABLE 3.21: WHICH MOBILE APPLICATION DO YOU PREFER TO USE IT FIRST?	39
TABLE 3.22: WHICH COMMUNICATION METHODS DO YOU PREFER TO RECEIVE NEWS FREQUENTLY?.....	39
TABLE 3.23: WHICH OPTION WOULD YOU LIKE TO USE TO COMMUNICATE WITH YOUR RELATIVES OR FRIENDS FREQUENTLY?.....	40

TABLE 3.24: IF YOU HEAR THAT A NATURAL DISASTER WILL HIT YOUR LIVING AREA WILL YOU SEARCH ON THE INTERNET FOR DIFFERENT PRECAUTIONARY MEASURES?.....	40
TABLE 3.25: DO YOU PROVIDE ANY DISASTER PRECAUTIONARY MEASURES ON SOCIAL MEDIA?.....	41
TABLE 3.26: DO YOU THINK THAT YOU WILL RECEIVE ANY DISASTER WARNING FROM SOCIAL MEDIA?.....	41
TABLE 3.27: WHICH DEVICE DO YOU USE IT TO LOG ON SOCIAL MEDIA DURING DISASTER?.....	41
TABLE 3.28: WHICH OPTION WOULD YOU LIKE TO USE TO COMMUNICATE WITH YOUR RELATIVES OR FRIENDS DURING THE DISASTER?.....	42
TABLE 3.29: WHICH TYPE OF MOBILE APPLICATIONS WOULD YOU FAVOR TO USE TO COMMUNICATE WITH YOUR RELATIVES OR FRIENDS AT THIS EVENT?.....	43
TABLE 3.30: WHICH MOBILE APPLICATION DO YOU PREFER TO USE IT FIRST?	43
TABLE 3.31: WILL YOU SEND OR RECEIVE REQUEST FOR HELP OR ASSISTANCE ON SOCIAL MEDIA?.....	44
TABLE 3.32: WILL YOU TRY TO DOCUMENT AND KNOW WHAT IS HAPPENING ON SOCIAL MEDIA DURING THE DISASTER?.....	44
TABLE 3.33: WILL YOU TRY TO INFORM OTHERS ABOUT ONE’S OWN CONDITION AND LOCATION AND LEARN ABOUT A DISASTER-AFFECTED INDIVIDUAL’S CONDITION AND LOCATION BY USING SOCIAL MEDIA?.....	44
TABLE 3.34: WHICH OPTION WOULD YOU LIKE TO USE TO COMMUNICATE WITH YOUR RELATIVES OR FRIENDS AFTER THE DISASTER?.....	45
TABLE 3.35: WHICH TYPE OF MOBILE APPLICATIONS WOULD YOU FAVOR TO USE TO COMMUNICATE WITH YOUR RELATIVES OR FRIENDS AFTER THE EVENT?.....	45
TABLE 3.36: WHICH MOBILE APPLICATION DO YOU PREFER TO USE IT FIRST?	46
TABLE 3.37: WILL YOU TRY TO HELP RESCUE TEAMS BY SENDING REPORTS OR VIDEOS OR PICTURES ON SOCIAL MEDIA?	46
TABLE 3.38: WILL YOU USE SOCIAL MEDIA TO SPREAD INFORMATION ABOUT AFFECTED OR RESCUE PLACES?.....	47

TABLE 3.39: WILL YOU PROVIDE AND RECEIVE INFORMATION ABOUT (AND DISCUSS) DISASTER RESPONSE, RECOVERY, AND REBUILDING; TELL AND HEAR STORIES ABOUT THE DISASTER ON SOCIAL MEDIA?.....	47
TABLE 3.40: WOULD YOU PREFER TO RAISE AND DEVELOP AWARENESS OF AN EVENT; DONATE AND RECEIVE DONATIONS; IDENTIFY AND LIST WAYS TO HELP OR VOLUNTEER ON SOCIAL MEDIA?.....	47
TABLE 3.41: WILL YOU TRY TO DOCUMENT OR INFORM PEOPLE OR GIVE ADVICE OR FOLLOW THE NEWS AT THAT TIME ON SOCIAL MEDIA?.....	48
TABLE 3.42: WILL YOU GET WORRIED AS YOU HEAR A STRESSFUL EVENT IS HAPPENING SOON?.....	48
TABLE 3.43: DO YOU FEEL VERY EMOTIONALLY UPSET WHEN SOMETHING REMINDED YOU OF THE STRESSFUL EVENT?.....	49
TABLE 3.44: DO YOU FEEL LIKE YOU ARE DETACHED OR DISTANT FROM YOURSELF, YOUR BODY, YOUR PHYSICAL SURROUNDINGS OR YOUR MEMORIES?.....	49
TABLE 3.45: DO YOU TRY TO AVOID THOUGHTS, FEELINGS, OR PHYSICAL SENSATIONS THAT REMINDED YOU OF THE STRESSFUL EVENT?.....	50
TABLE 3.46: BEING "SUPER ALERT," ON GUARD, OR CONSTANTLY ON THE LOOKOUT FOR DANGER?.....	50
TABLE 3.47: DO YOU FEEL JUMPY OR EASILY STARTLED WHEN YOU HEAR AN UNEXPECTED NOISE?.....	51
TABLE 3.48: DO YOU GET EXTREMELY IRRITABLE OR ANGRY AT ANY POINT WHERE YOU SCREAM ON OTHER PEOPLE, GET INTO FIGHTS, OR DESTROYED THINGS?.....	51
TABLE 3.49: ARE YOUR WORRIES ABOUT THE EVENT REACHING THE DEGREE OF PANIC ATTACK?.....	52
TABLE 3.50: FEELING VERY EMOTIONALLY UPSET WHEN YOU ARE EXPERIENCING THE TRAUMATIC EVENT?.....	52
TABLE 3.51: FEELING DETACHED OR DISTANT FROM YOURSELF, YOUR BODY, YOUR PHYSICAL SURROUNDINGS, OR YOUR MEMORIES?.....	53
TABLE 3.52: TRYING TO AVOID THOUGHTS, FEELINGS, OR PHYSICAL SENSATIONS THAT YOU'RE EXPERIENCING DURING THE STRESSFUL EVENT?.....	53
TABLE 3.53: BEING "SUPER ALERT," ON GUARD, OR CONSTANTLY ON THE LOOKOUT FOR DANGER?.....	54

TABLE 3.54: FEELING JUMPY OR EASILY STARTLED WHEN YOU HEAR AN UNEXPECTED NOISE?.....	54
TABLE 3.55: BEING EXTREMELY IRRITABLE OR ANGRY TO THE POINT WHERE YOU YELLED. AT OTHER PEOPLE, GOT INTO FIGHTS, OR DESTROYED THINGS?	55
TABLE 3.56: HAVING “FLASHBACKS,” THAT IS, YOU SUDDENLY ACTED OR FELT AS IF A STRESSFUL EXPERIENCE FROM THE PAST WAS HAPPENING ALL OVER AGAIN (FOR EXAMPLE, YOU RE-EXPERIENCED PARTS OF A STRESSFUL EXPERIENCE BY SEEING, HEARING, SMELLING, OR PHYSICALLY FEELING PARTS?.....	55
TABLE 3.57: FEELING VERY EMOTIONALLY UPSET WHEN SOMETHING REMINDED YOU OF A STRESSFUL EXPERIENCE?.....	56
TABLE 3.58: FEELING DETACHED OR DISTANT FROM YOURSELF, YOUR BODY, YOUR PHYSICAL SURROUNDINGS, OR YOUR MEMORIES?.....	56
TABLE 3.59: TRYING TO AVOID THOUGHTS, FEELINGS, OR PHYSICAL SENSATIONS THAT REMINDED YOU OF A STRESSFUL EXPERIENCE?.....	57
TABLE 3.60: BEING "SUPER ALERT," ON GUARD, OR CONSTANTLY ON THE LOOKOUT FOR DANGER?.....	57
TABLE 3.61: FEELING JUMPY OR EASILY STARTLED WHEN YOU HEAR AN UNEXPECTED NOISE?.....	58
TABLE 3.62: BEING EXTREMELY IRRITABLE OR ANGRY TO THE POINT WHERE YOU YELLED AT OTHER PEOPLE, GOT INTO FIGHTS, OR DESTROYED THINGS?	58
TABLE 3.63: NORMAL DISTRIBUTION TESTS OF THE HUMAN BEHAVIORS DATA.....	59
TABLE 3.64: PAIRED SAMPLE STATISTICS RESULTS FOR HUMAN BEHAVIOR GROUPS BEFORE AND AFTER-352 DATA	66
TABLE 3.65: PAIRED SAMPLE CORRELATIONS RESULTS FOR HUMAN BEHAVIOR GROUPS BEFORE AND AFTER-352 DATA.....	66
TABLE 3.66: PAIRED SAMPLE TEST RESULTS FOR HUMAN BEHAVIOR GROUPS BEFORE AND AFTER-352 DATA.....	67
TABLE 3.67: PAIRED SAMPLE STATISTICS RESULTS FOR HUMAN BEHAVIOR GROUPS BEFORE AND DURING-352 DATA.....	69
TABLE 3.68: PAIRED SAMPLE CORRELATIONS RESULTS FOR HUMAN BEHAVIOR GROUPS BEFORE AND DURING-352 DATA.....	69

TABLE 3.69: PAIRED SAMPLE TEST RESULTS FOR HUMAN BEHAVIOR GROUPS BEFORE AND DURING-352 DATA	69
TABLE 3.70: DESCRIPTIVE STATISTICS RESULTS BETWEEN THE HUMAN BEHAVIORS BEFORE, DURING AND AFTER A DISASTER OCCUR.....	70
TABLE 3.71: CORRELATIONS RESULTS BETWEEN HUMAN BEHAVIORS BEFORE, DURING AND AFTER A DISASTER OCCUR	71
TABLE 3.72: STATISTICS RESULTS FOR HUMAN BEHAVIOR GROUP'S BEFORE (141-DATA) AND BEFORE (211-DATA)	72
TABLE 3.73: INDEPENDENT SAMPLE TEST FOR TWO GROUPS (BEFORE-141 AND BEFORE 211).....	73
TABLE 3.74: STATISTICS RESULTS FOR HUMAN BEHAVIOR GROUP'S AFTER (141-DATA) AND AFTER (211-DATA)	75
TABLE 3.75: INDEPENDENT SAMPLE TEST FOR TWO GROUPS (AFTER-141 AND AFTER-211).....	75
TABLE 3.76: USING OF SOCIAL NETWORK APPLICATIONS (RESULTS BEFORE A DISASTER HAPPENS).....	77
TABLE 3.77: USING OF SOCIAL NETWORK APPLICATIONS (RESULTS DURING A DISASTER HAPPENS).....	78
TABLE 3.78: USING OF SOCIAL NETWORK APPLICATIONS (RESULTS AFTER A DISASTER HAPPENS).....	79
TABLE 3.79: CITIZENS IN GENERAL PREFER TO COMMUNICATE WITH THEIR RELATIVES AND FRIENDS USING MOBILE CALL; DATA BEFORE DISASTER	81
TABLE 3.80: CROSS TABULATION BETWEEN COUNTRY AND COMMUNICATION OPTIONS (DATA BEFORE DISASTER).....	82
TABLE 3.81: CITIZENS IN GENERAL PREFER TO COMMUNICATE WITH THEIR RELATIVES AND FRIENDS USING MOBILE CALL; DATA DURING DISASTER EVENT	83
TABLE 3.82: CROSS TABULATION BETWEEN COUNTRY AND COMMUNICATION OPTIONS (DATA DURING-DISASTER).....	83
TABLE 3.83: CITIZENS IN GENERAL PREFER TO COMMUNICATE WITH THEIR RELATIVES AND FRIENDS USING MOBILE CALL; DATA AFTER DISASTER EVENT	84
TABLE 3.84: CROSS TABULATION BETWEEN COUNTRY AND COMMUNICATION OPTIONS (DATA AFTER-DISASTER).....	85

TABLE 3.85: CORRELATION BETWEEN TIMES SPENT ON SOCIAL MEDIA SITES AND GENDER TYPE.....	87
TABLE 3.86: RELATIONSHIP BETWEEN TIME DURATION SPENDING ON SOCIAL MEDIA SITES AND AGE RANGE (1)	88
TABLE 3.87: RELATIONSHIP BETWEEN TIME DURATION SPENDING ON SOCIAL MEDIA SITES AND AGE RANGE (2)	88
TABLE 3.88: RELATIONSHIP BETWEEN TIME SPENDING ON SOCIAL MEDIA SITES AND EDUCATION LEVELS.....	90
TABLE 3.89: CORRELATION RESULTS BETWEEN USAGES OF IoT TECHNOLOGY IN THE FUTURE AND AGE LEVELS.....	90
TABLE 3.90: CROSS TABULATION AND FREQUENCY RESULTS BETWEEN USAGE OF IoT TECHNOLOGY IN THE FUTURE AND AGE LEVELS.....	91
TABLE 3.91: APPROVED RESULTS OF HYPOTHESIS.....	92
TABLE 4.1: SUMMARY OF HUMAN BEHAVIOUR PROFILE AS REPORTED BY PARTICIPANTS OF THE CURRENT STUDY; BEFORE DISASTER.....	97
TABLE 4.2: SUMMARY OF HUMAN BEHAVIOUR PROFILE AS REPORTED BY PARTICIPANTS OF THE CURRENT STUDY, DURING DISASTER.....	98
TABLE 4.3: SUMMARY OF HUMAN BEHAVIOUR PROFILE AS REPORTED BY PARTICIPANTS OF THE CURRENT STUDY; AFTER DISASTER.....	99
TABLE 4.4: COMPARISON OF PARTICIPANTS' BEHAVIOURAL SUFFERING AND EXPERIENCE PROFILE (THOSE WHO SAY "Yes") BEFORE, DURING, AND AFTER THE DISASTER.....	100
TABLE 4.5: THE DIFFERENT BETWEEN IRAQ & TURKEY ABOUT MOBILE APPLICATIONS MOST USAGE IN THE THREE STAGES OF DISASTER.....	101
TABLE 4.6: COMMUNICATION WAYS RESULTS FOR THREE STAGES OF DISASTER.....	102
TABLE 4.7: SOCIAL MEDIA APPLICATIONS RESULTS FOR THREE STAGES OF DISASTER...	103
TABLE 4.8: COMMUNICATION CHANNELS RESULTS FOR STAGE BEFORE DISASTER.....	104
TABLE 4.9: RESULT OF A QUESTION: DO YOU THINK THAT YOU WILL RECEIVE ANY DISASTER WARNING ON SOCIAL MEDIA? (BEFORE DISASTER PART).....	104
TABLE 4.10: RESULTS OF QUESTIONS ABOUT POSSIBLE REACTION FROM RESPONSES (DURING DISASTER PART).....	105

TABLE 4.11: RESULTS OF QUESTIONS ABOUT POSSIBLE REACTION FROM RESPONSES (AFTER DISASTER PART).....	105
TABLE 4.12: SUMMARY OF IoT AS REPORTED BY PARTICIPANTS OF THE CURRENT STUDY.....	107



FIGURES

FIGURE 3.2: HISTOGRAM DISTRIBUTION AND NORMAL Q-Q PLOT DISTRIBUTION OF HUMAN BEHAVIOUR BEFORE DISASTER; RESULTS OF 352 RESPONDERS.....	60
FIGURE 3.3: HISTOGRAM DISTRIBUTION AND NORMAL Q-Q PLOT DISTRIBUTION OF HUMAN BEHAVIOUR DURING DISASTER; RESULTS OF 352 RESPONDERS.....	60
FIGURE 3.4: HISTOGRAM DISTRIBUTION AND NORMAL Q-Q PLOT DISTRIBUTION OF HUMAN BEHAVIOUR AFTER DISASTER; RESULTS OF 352 RESPONDERS.....	60
FIGURE 3.5: HISTOGRAM DISTRIBUTION AND NORMAL Q-Q PLOT DISTRIBUTION OF HUMAN BEHAVIOUR BEFORE DISASTER; RESULTS OF 211 RESPONDERS.....	61
FIGURE 3.6: HISTOGRAM DISTRIBUTION AND NORMAL Q-Q PLOT DISTRIBUTION OF HUMAN BEHAVIOUR AFTER DISASTER; RESULTS OF 211 RESPONDERS.....	61
FIGURE 3.7: HISTOGRAM DISTRIBUTION AND NORMAL Q-Q PLOT DISTRIBUTION OF HUMAN BEHAVIOUR BEFORE DISASTER; RESULTS OF 141 RESPONDERS.....	61
FIGURE 3.8: HISTOGRAM DISTRIBUTION AND NORMAL Q-Q PLOT DISTRIBUTION OF HUMAN BEHAVIOUR BEFORE DISASTER; RESULTS OF 141 RESPONDERS.....	62
FIGURE 3.9: CONCEPTUAL FRAMEWORK OF THE STUDY	63
FIGURE 3.10: BAR HISTOGRAM OF THE FREQUENCY RESULTS DATA OF HUMAN BEHAVIOUR THROUGHOUT STAGES OF DISASTER, BEFORE, DURING, AND AFTER EVENT; TOTAL NUMBER OF PARTICIPANTS WAS 352.....	65
FIGURE 3.11: TEST STATISTICS FOR THE PAIRED SAMPLE T-TEST FORMULA.....	68
FIGURE 3.12: BAR HISTOGRAM SHOWING FREQUENCY RESULTS OF HUMAN BEHAVIOUR; DATA BEFORE-DISASTER OF 141 PARTICIPANTS AND OF THE REST 211 PARTICIPANTS, ALSO BEFORE DISASTER.....	72
FIGURE 3.13: TEST STATISTIC COMPUTED FORMULA FOR THE EQUAL VARIANCES ASSUMED	74
FIGURE 3.14: BAR HISTOGRAM OF THE FREQUENCY RESULTS OF HUMAN BEHAVIOUR AFTER DISASTER; DATA FOR THE TWO GROUPS, THE 141 AND THE 211 PARTICIPANTS.....	74
FIGURE 3.15: BAR GRAPHIC OF THE FREQUENCY RESULTS FOR WHICH MOBILE APPLICATIONS POTENTIALLY WILL BE USED BEFORE DISASTER OCCURRENCE IN TURKEY, AND IRAQ	77

FIGURE 3.16: BAR GRAPHIC OF THE FREQUENCY RESULTS FOR WHICH MOBILE APPLICATIONS POTENTIALLY WILL BE USED DURING DISASTER OCCURRENCE IN TURKEY, AND IRAQ	79
FIGURE 3.17: BAR GRAPHIC OF THE FREQUENCY RESULTS FOR WHICH MOBILE APPLICATIONS POTENTIALLY WILL BE USED DURING DISASTER OCCURRENCE IN TURKEY, AND IRAQ	80
FIGURE 3.18: BAR HISTOGRAM SUMMARY OF THE RESULTS REGARDING WHICH OPTIONS PEOPLE PREFER TO USE IT TO COMMUNICATE WITH THEIR RELATIVES AND FRIENDS BEFORE, DURING, AFTER DISASTER.....	86



ABBREVIATIONS

BDC	:	Brinco Data Center
CERT	:	Community Emergency Response Team
FEMA	:	Federal Emergency Management Agency
GPS	:	Global Positioning System
IOT	:	Internet of Things
ICTs	:	Information and Communication Technology
ISCRAM	:	Information System for Crisis Response and Management
LAFD	:	Los Angeles Fire Department
PIO	:	Public Information Officers
RFID	:	Radio Frequency Identification
UAVs	:	Unmanned Aerial Vehicles
UGVs	:	Unmanned Ground Vehicles
WEA	:	Wireless Emergency Alerts
WSNs	:	Wireless Sensor Network

1. INTRODUCTION

Disasters can happen at any time, and we all as people on this earth have witnessed this fact in the last couple of months coronavirus has reshaped our lives, each type of disaster has different effects and damages that one should recover from and from that point comes the importance of planning a more structured way to deal with disasters and planning for the worst case scenarios, this year proved the importance of disaster management. (Mehdi Najafi, 2017) defined disaster as a serious disruption of the functioning of a community or a society involving widespread human, material, economic and environmental loss; sequelae may exceed the ability of the affected community or society to cope with using its own resources. While disasters can be natural or man-made; they can take many forms such as earthquakes, tsunami, industrial poisonous, terrorist attacks, forest fire, airplane crash (J John Wellington, 2017). Researchers have been studying disasters for more than a century. When discussing disaster management there are a few processes that form the links in the chain and work in tandem to complete the disaster management lifecycle. The process starts with the disaster mitigation, preparedness, response, and lastly recovery (Diaz P. I., 2013).

Many essential tools like information and communication technology (ICT), including social media, have proven their substantial roles during disasters minimizing disaster's sequelae (Palen L. A., 2010). According to Statistic 4.8 billion people own a mobile phone which is 61% of the world population, 3.5 billion is the current number of smartphone users around the world which means 45% of the world population has access to smartphones these are rescuers which governments and aid organizations should take advantage of, the IoT or any digital communications tools that people use to report events, ask for help, exchange information and communicate with rescue organizations and relief workers within seconds across long distances in our planet (Pine, 2018).

Many organizations working to reduce humanitarian suffering have agreed that the first few hours are quite essential and crucial in the assessment of any disaster events, whether have been expected in advance or surprised our existence, in terms of making decisions regarding what sort of help and aids are needed, the bulk of those needs, humanitarian and materialistic logistic requirements, and other specific measures to adequately deal with the circumstances and the time period that follow in an effective and appropriate modern way (OCHA, 2017). Therefore, it is essential to make use of, and practice an excellent ingenuity in transforming all advances in communication tools into real practice. When talking about IoT technology one thing comes to mind is a worldwide network of interconnected devices (INFISO, 2008). The technology has the potential to realize complex decision support systems by delivering the required service in more accurate, organized and intelligent manner (Xu et al., 2014); (Gershenfeld et al., 2004); (Gubbi et al., 2013). During disasters efficiency, precision and time management are considered to be important factors the IoT has the potential to be a key player for making these factors happen (Wang et al., 2008).

Online social networking services and social media like Facebook, Twitter, WhatsApp, Instagram, Etc. play an important role in solving many problems during disasters. Social media allow the establishment of global relationship, studies have showed that the use of social media have overpassed the use of conventional methods such as fixed phones during disasters. Companies are using their own social media networking in order to continue their business during disasters (A. Srikanth, 2012). Social media provides valuable information and drives awareness, the use of social media is affected by human behavior, people can use social media to better prepare themselves or communities before a disaster (M. Loveland, 2011). While during disasters people tend to use social media to communicate information to their families, organizations or health centers. After the disaster social media helps bring people together to discuss and share information.

Regarding the thesis, human behavior with IoT and social media for disaster management, there have been many researchers in the disasters' literature regarding human behavior, the use of IoT and social media; those researches presented and discussed those parameters separately and independently. However, in this study we obtain to deal with those variables collectively and interactively all three together. Moreover, since human being is considered as “social being”, and it's not surprising how the social media became a tool to interact with others not only during disaster, we aim to analyze the human behavior usage of social media and IoT, and their psychological reactions before, during and after disasters through collecting information regarding their previous experiences, in order to help organizations, business and healthcare sectors in planning a more thorough management of disasters.

In order to explore human behavior and reactions before, during and after disasters, we conducted a survey. Its questions targeted human behavior usage of IoT and social media before, during and after a disaster. In order to build a reliable, consistent and transparent survey, a thorough literature review has been done that included the data which is gathered from different articles in journals and newspapers, and books to figure out the way of using social media and IoT in disaster management.

Three hundred and fifty two participants had responded to the questionnaire, the survey results show that the numbers of the females were 155, males were 217; however 20 participants preferred not to mention their gender. Moreover, the results show that 44% of the responders said that they faced kind of disaster during their live while 38% of them admit they didn't take any disaster management courses.

1.1 PROBLEM STATEMENT

Technology is not only changing the way we communicate. It's also changing the way we do business, and the way we live in our communities. people are using the IoT and social media during disasters or human-created catastrophe, the lack of detailed way of people usage of IoT and social media not only determining the most popular platform which is being used during disasters but how human behavior effects the way they are using theses platforms (getting information, social reasons or aid) and how it could be implemented in disaster management. With the existence of IoT and social media it makes easier to communicate in an interactive form rather than static during disasters taking in consideration that people are emotional beings and due to that, their behavior can change during disaster.

For that reason in the current study, attempts are made to explore, among a group of people from many countries, mainly from Turkey and Iraq,

1. How they may feel (or their past experience) about disaster (psychological aspect, human behaviour),
2. The social media they may use (or had used) during the disaster, and,
3. Provision of the advantages of using Internet of Things (IoT) and social media in disaster management.

1.2 ASSUMPTIONS OF THE STUDY

In the current study nine hypotheses have been assumed (**H1-9**).

H1.A There is a difference in human behaviors in terms of their emotional felling (Getting worried, feeling upset, being extremely angry) before and after disaster occurrence (Total number of participants in the survey was 352).

H1.B There is a difference in human behaviors in terms of their emotional felling (Getting worried, feeling upset, being extremely angry) before and during disaster occurrence (Total number of participants in the survey was 352).

H2 There is a correlation between human behaviors before, during and after a disaster occurrence.

Important Note: For the hypothesis no.H.3 (A, B) the data of the survey divided into two parts depended on the event (earthquake that hit Istanbul on the 26th of September, 2019 at 13:59 pm and measured 5.8 on Richter scale).

First part: The data that were collected from June until 25 of September; there were (141 participants).

Second part: The data that were collected from 26 of September until end of November; there were (211 participants).

Moreover, the test on the human behavior, data before and after earthquake and each part was divided into 3 parts: before, during, and after disaster occurrence.

H3.A There is a difference in human behaviors that can be observed as expressed by the participants in terms of their emotional felling (Getting worried, feeling upset, being extremely angry). Before part questions (Number of participants were 141) and after part questions (Number of participants were 211).

H3.B There is a difference in human behaviors that can be observed as expressed by the participants in terms of their emotional felling (Getting worried, feeling upset, being extremely angry). After part questions (Number of participants were 141), and before part questions (Number of participants were 211).

H4. Using of social media applications during disaster event could be different from country to another.

H5 Citizens in general prefer to communicate with their relatives and friends using mobile call more than social media applications in all the stages of disaster.

H6 There is a relation between spending time on social media sites and gender type.

H7 Younger generation is more likely to spend time on social media sites than middle age group generation.

H8 There is a correlation between time spending on social media sites and the education level.

H9 There is a relation between using IoT technology and age levels.

1.3 MOTIVATION OF THE STUDY

- a. To study among a group of people, including university students, the internet's application(s) they are most likely and currently been using in daily life. This shows us the pattern of internet and mobile usage that they shall be using in the event of disaster.
- b. By exploring the human behavior patterns in terms of Social Media and IoT usage, communication parties such as internet service provider, application servers, and mobile GSM companies can arrange their resource management during and after disaster.
- c. The study may provide a feedback to governmental foundations and / or private sector establishments, who provide the internet networking services, that, for national responsibilities and commitments, both should keep the integrity of the infrastructure necessary in maintaining and supporting the internet services running efficiently before, during, and after disaster.
- d. The psychological reaction of members of the study group, who are coming from both rural and urban areas, they may experience and suffer before, during, and after disaster event. This may reflect the attitude of other members of the society.

- e. At national level, keeping with findings under number 3 above, specialized foundations may design and instruct the society members appropriate educational psychological programmes that will minimize impact of disaster on peoples' mind and speed up recovery.
- f. To create awareness among the people about disasters and its consequences and prepare them to face such situations and to ensure their participation in the disaster mitigation plans.
- g. To setup educational and training institutions for educating communities about the importance of disaster management courses.
- h. Spot the light on the necessity of setting a plan to care about elderly, disabled people, and children who represent a large segment of the societies, to be safely evacuated and moved to more secure places like well-equipped shelters and camps.

1.4 ORGANIZATION OF THE THESIS

Chapter 1 gives introduction and a brief description about the problem statement and the scope of the thesis and highlights the reasons of choosing the topic of human behavior with IoT and social media for disaster management.

Chapter 2 outlines the general background of Internet of Things, Social Media, and Human Behavior reactions especially in disaster's situations. It provides a review of the different products, applications and services which are used and designed in case a disaster occurs.

Chapter 3 figures out the results of the survey conducted regarding the use of IoT, Social Media and human behavior before, during and after the disaster. It gives the results of proved hypothesis by this survey.

Chapter 4 provides the findings and discussion on the proved hypothesis related to human behavior analysis and using of IoT and social media for disaster management. Also, it provides the importance of different social media application used in Turkey and Iraq.

Chapter 5 concludes the thesis by providing the solution of proper usage of social media and Internet of Things minimize and lessen the impact of the disasters, and the important of expectation of human behavior psychological feeling in disaster cycle.



2. GENERAL BACKGROUND

2.1 INTERNET OF THINGS FOR DISASTER MANAGEMENT

The Internet of Things (IoT) is a network of devices with the ability to connect to each other through the internet without the need of human involvement (Pine, 2018). This network encompasses a variety of devices, or actors, such as cell phone signals, sensors, and global positioning systems (GPS) (L. Yang, 2012). The term was coined in a conference in 1999, with the idea of developing technologies that can observe and learn the world beyond the data entered by humans (Ashton, 2009). This technology dates back to the 1980s, and gained track in the 1990s, up to present day, when the technology evolved to apply its capabilities in our day to day lives, in areas such as health care, environment monitoring, social network, and home appliances (L. Yang, 2012). IoT has been incorporated in disaster management through a series of emergency systems that relies on various types of sensors. Utilizing its Wireless Sensor Network (WSN) and Machine-to-Machine (M2M), IoT functions in disaster management through data collection, analysis of sensor-gathered data, real-time examination, and victim localization using space technology, WSN, and other applications, which provides the actors in disaster management and prevention with the ability to apply precautionary measures, send out warnings, and the ability to monitor remote areas.

Scientist and researchers always explore new horizons for a safe and competent information transfer means that can be delivered to the targets, without being affected, for proper utilization.

In this context, due to the instantaneous nature of disasters, and the dangers it holds, it is crucial to have a reliable system to detect it and properly manage it. Some disasters, such as earthquakes and floods can affect the ordinary communications systems, which can slow down the response to said disasters due to the inability to deliver the information to the responsible responders (Elsevier Science Ltd, 1997). Thus one of the most significant requirements for disaster detection is to have a

dependable way to ensure information is securely transmitted in a short time (Elsevier Science Ltd, 1997). One of the most secure and dependable information delivery systems is through the utilization of the current space technologies. Space technologies, such as satellites, are not affected by any disaster that happens, and can cover a great geographical area, which makes them a vital source of acquiring information about disasters. Space technology is the safest way to acquire the required continuous data, in remote and out of reach zones, which in turn could be utilized in taking preventive measures through vulnerability analysis, hazard zoning and an earlier hazard evaluation at provincial and residential levels (Elsevier Science Ltd, 1997).

Satellite-based climate estimates and preemptive guidance of extreme climate will limit death toll and harm and encourage appropriate and effective rescue, relief, and recovery of affected populations. Satellites are especially fit to convey district explicit disaster warnings and correspondence to the remote, rustic and underdeveloped zones. Satellites assume a significant job in giving reliable assessments of the harm, area of unsafe territories, and evaluation of post disaster circumstances.

Satellite correspondence gives a proficient method for giving convenient guide and organizing rescue endeavors by central relief management agencies. A strong initiative for incorporating data recovered from various sources is called for to address the pivotal issues of disaster management in an organized way. There is a possibility of connecting Earth Perception and Correspondence and Navigation Satellites to create a worldwide data framework which could offer practical solutions for various issues identified with disaster management; however, it tends to be upgraded uniquely with international collaboration (Elsevier Science Ltd, 1997).

In addition to what have been mentioned above, another form of data collection and monitoring that is utilized is through WSN. WSNs, such as Radio-Frequency Identification (RFID) tags, Infrared Sensors, GPS, and barcodes are the main source of ground data collection. WSNs provide real-time information about environmental conditions, and location of structures, humans and animals. WSN technologies can't

prevent disasters from taking place, however they are accommodating for disaster readiness, like forecast and early cautioning frameworks. An example of WSN abilities is the remarkable models used in the recognition of forest fires; sensors on trees will send a signal once a fire has broken out, in addition to the detection of changes in temperature, moisture, and carbon monoxide (CO) levels. When a change is drastic enough to cause a potential disaster, early cautioning frameworks would alert the local population. GPS data of the infrared sensors can aid firemen by providing point by point data which can be utilized in preventing a bigger forest fire. Other examples of IoT applications are microwave sensors which are to detect earth developments, such as seismic earthquakes, infrared sensors which are used in sensing floods, and often utilized to recognize slope development that can predict an avalanche (Frigerio, 2014), while barcode and GPS data can detect movement of people that aids in evacuations. In the event in which a crisis occurs, people are cautioned through web-based communications, standard media channels and SMS. In high-chance regions, alarms additionally are utilized to clear the most populated areas (Himadri Nath Saha, 2017). WSNs require multi bounce correspondence to enable transmitted information to arrive at the master hub; however along these lines a solitary ruined hub can make the framework ineffective. This is where Unmanned Aerial Vehicles (UAVs) and Unmanned Ground Vehicles (UGVs) can be useful alternatives. A UAV/UGV can be sent to the site of a disaster to screen the area when the WSN comes up short or even to associate with the WSN if there are failing in some piece of the framework (Ueyma, 2014).

During any disaster reaction and recuperation, WSNs, UAVs, and UGVs can be utilized to scan for casualties of any mishap. For instance, sensors set within a structure can be useful in deciding the area of wounded people in case of a structure breakdown (Pogkas N. K., 2007). UAVs can be utilized to scan for unfortunate casualties and to set up a correspondence framework when the electrical cables, smartphone towers, and antennas have been damaged.

Advances in technology industry have led to substantial achievements in manufacturing reliable and helpful systems and tools, which are made available at commercial levels, supporting IoT-based disaster management solutions (Partha

Pratim Ray, 2017). Such systems may include Earthquake Detecting Alarm Systems, Flood Detecting Alarm Systems, Lightning Detection System, Landslide Detection ALARMS, and other IoT-empowered devices, e.g. BRCK.

In the setting of Earthquake Detecting Alarm Systems, Brinco is the first IoT-empowered guide that is intended to inform its client about conceivable seismic tremor or waves in close to home mindful mode. The sensor framework contains an accelerometer, signal handling unit and sound caution units. If a sensor detects any vibration of the ground, it sends this data to the Brinco Data Center (BDC), a private cloud administration. The data center engages this data with other seismic systems data to get its perception. If the system feels the judgment is enough, it sends out an alarm to its users immediately (Partha Pratim Ray, 2017). A product to Brinco is Grillo, the major earthquake detection and alarm system in Mexico (Partha Pratim Ray, 2017).

Another similar tool that detects earthquakes is MyShake; however, unlike the previously mentioned Brinco, this application uses client's smartphones as a sensor. When the application detects a ground vibration through the phone's accelerometer, it plays out a match activity with the vibrational profile of the tremor. Whenever coordinated, the data alongside the present GPS arrangement is sent for examination to the Berkeley Seismological Research facility (BSL) for final crosscheck. This has opened an approach to build up an economical, appropriated and publicly supported earthquake monitoring system that is clearly the requirement of time (Partha Pratim Ray, 2017).

Concerning floods-disaster-management, Citizen Flood Detection Network is an open group detecting IoT-empowered framework that is associated with flood detecting hubs around the world. The current structure of the hub includes Raspberry Pi, ultrasonic range discoverer, and switch. The hub, which is generally installed under the river bridge, measures the water level at each five-minute interim. The information is then transmitted to the mapper-administration of the remote cloud for ongoing checking of current flood settings. When the water-level exceeds the predefined well-being level, the map changes colors (e.g. yellow and red). At the same time, the notifications are additionally sent to the nearby control points and

associated individuals over the Web (Partha Pratim Ray, 2017). Other services available is Flood Beacon, which uses beacons placed on water bodies to analyze the flow of water level and detect an abrupt change and report it in a cloud database. This is predominantly used in real time monitoring of Tsunami, where once the sensors detect a change in water levels; it sends notifications to nearby people (Partha Pratim Ray, 2017). Additionally, University of California developed a similar, but more versatile and economical floating device that covers GPS and acceleration sensors that detect any change in water level and sends out an alert to surrounding areas through the internet (Partha Pratim Ray, 2017).

Regarding risks of naturally occurring lightning disasters, lightning takes around 24,000 lives around the world each year. To counter this natural hazard, this IoT-based lightning identifier was created. Raspberry Pi fitted lightning identifier is connected with a lightning sensor that can detect little change in gamma impact (occur in substantial lightning) from 40 km away. This framework sends the lightning information to the remote server at every 15 minutes interval. Once verified, the data is promptly sent to the nearby individuals over the web to take shelter from the lightning (Partha Pratim Ray, 2017).

On the other hand, dealing with landslides-disaster occasions, the British Geological Survey has introduced an application called Assessment of Landslides using Acoustic Real-time Monitoring Systems (ALARMS) at different areas to detect any landslide. To acquire slope variability, an accelerometer-based sensor framework is conveyed over the slope area where landslide is avoidable. According to the movement and change in the density of the slope, an early warning is sent to the nearby areas (Partha Pratim Ray, 2017).

BRCK is a flexible IoT-empowered device intended to be utilized in poor frameworks. This gives it capacity to interface with low availability regions where 2G communications still exist. It can work with solar energy, which makes it ideal for areas with weak to no availability of electricity. These abilities make BRCK the most affordable item to be used in disaster affected areas. Similar to Brinco, BRCK utilizes its cloud database and sends alerts to its users over Wi-Fi (Partha Pratim Ray, 2017).

2.2 SOCIAL MEDIA FOR DISASTER MANAGEMENT

Today, in this era of millennia everyone is aware of social media. Even in most of the remote areas where access to the internet is limited, the people are aware of social media platforms such as Facebook and Twitter. Social media is defined as open web-based services and user friendly that provide the users to interact with the world through messages, pictures and videos within a limited or open boundary. It provides a platform to the users to make friends, business-related connections, and to view or navigate their list of connections according to their will (Chikezie E., 2018). All these connections can vary depending on the nature of the website (National Research Council, 2011). These capabilities provided by the platforms make it a big player in disaster management and response.

With increased access to the internet, number of cell phones and availability of new ways to import data to the world, the various hierarchical patterns typically utilized by crisis management organizations—top-down, control-and-command—have been challenged by a framework in which non-responders now have the ability to report and add to situational responsiveness (Latonero, 2011). The long time it takes for traditional media to report an incident is one of the main reasons why people affected by emergency circumstances turn to social media in search for data. At the point when standard mass-messaging communications systems went down, social media helps fill the void. For example, in 2008 during tropical storm Gustav, a Community Emergency Response Team (CERT) utilized social media to send mass email notifications to colleagues through Facebook when its call notification framework went down. The CERT team additionally refreshed status messages to tell first responders and residents of developments as the incident unfurled (Lindsay, 2011).

Today, social media giants such as Facebook and Twitter became the main source of real-time information, with features such as trends highlighting important events that are happening at the moment. Additionally, social media websites have drawn a feature in their websites and applications to facilitate the crisis managers in a way by providing them with a specific media outlet with a target audience with messages on precautions and actions to be taken before or during the disaster. This has become a

requirement to aid crisis managers, commonly known as the Public Information Officers (PIO), a job that includes monitoring the public information arena during a crisis, avoiding false rumors and correcting misinformation (Hughes, 2012). PIOs, in interviews with researchers, communicated that social media extends not just the scope and sort of PIO work activity, but the “Information Pathways” that exist between PIOs, the media, and individuals from the general public (Hughes, 2012). This aggregate knowledge, called “crowdsourcing,” is the collection of resources, capacities, and a movement to progressively increase characterized tasks and even authoritative identity in light of an occasion (Starbird K. M., 2012). These features became a vital way to spread information about ongoing events, especially news and disasters. Data shared by users about disasters creates the initial awareness of an ongoing event, which is later verified by PIOs and shared through news outlets accounts has become the most vital way of sharing news since it is rapid and can reach more audience as today most people get their news and updates from news accounts on social media rather than hearing about it from television or radios (Hughes, 2012). Starbird saw that Twitter clients re-tweet messages from official data sources, such as crisis management or news media associations which helped spread the news quickly (Starbird K. M., 2012). During any emergency, Twitter communication falls into following four categories (Latonero, 2011): Automatic messages sent to the users’ network during any disaster, Users re-tweeting messages they get from their news-providers accounts. Disaster management sends messages using their account to public in affected areas; and lastly, disaster management officials gather information about the disaster through feedback and share it with other authorities involved in crisis management.

The use of social media to spread awareness about disasters is supported by the Federal Emergency Management Agency (FEMA) executive Fugate, who has called social media a “basic to crisis management, because the general public utilizes these communication tools regularly. Social media must be fully utilized among the general public as a basic accomplice in our efforts” (Diaz P. I., 2013). A study dispatched by the American Red Cross found that generally 50% of the respondents would pursue e-mails, text-based notifications, or different applications for emergency data to help

them during a crisis circumstance (Lindsay, 2011). However, information gathered from social media presents a new challenge; how to filter applicable data from the sheer volume of information being communicated by users. User-created content is normally “uproarious” and utilizes unexpected language in comparison to traditional print communication records (Yin, 2012). This is where PIOs and crowdsourcing plays a major role, as they can analyze all the information available to essentially filter it through verifying status reports, geo-tagging the data, and approve it for spread by news outlets (Gao, 2011). This sort of collaboration keeps on improving the quality of news delivered to the public and aids in controlling the population’s crisis reaction. A few services build on existing frameworks to combine data. Ushahidi is a social media network that coordinates information from various sources such as telephones, web applications, email and social media websites to give a publicly available emergency map that is easily accessible to relief associations (Gao, 2011).

Social media could be utilized to estimate damages by examining shared pictures of harmed structures. High-resolution elevated and satellite pictures on the web, through Google's Emergency Response Application, gave an important asset to individuals in the 2005-2006 Gulf Coast hurricane season (Palen L. &., 2007). Such capabilities can assist the response efforts in gathering and giving data valuable to the general population; however it still requires confirmation and verification before it can be utilized. During response endeavors, a virtual volunteer association appoints numerous volunteers to the task of “media monitoring,” an action that incorporates recognizing and making arrangements of on-the-ground Twitters. For volunteers like these, the utilization of systems that expand the signal-to-noise proportion in the information can possibly lessen the measure of work they have to do (Starbird K. M., 2012).

One of the recommendations to improve the usefulness of social media during disasters is through having a platform for each kind of mass crisis would be invaluable on the grounds that FEMA could give a wide scope of data significant to the particular occasion, including evacuation details, food, water and shelter areas, just as connections to different destinations or actual areas where occupants could

discover and acquire other fundamental needs (Lindsay, 2011). Social media could likewise be utilized to give timely response and recuperation updates to keep residents informed regarding advancements as the incident occurs. Additionally, authorities can take advantage of two-way correspondence with victims by incorporating arrangements of the dead and injured and contact data of victims' family and friends (Lindsay, 2011). Specialists concentrating on the utilization of Twitter during the March 2011 Japanese earthquake and tsunami wave found that those with Twitter accounts tweeted for help when they couldn't utilize the telephone option. If FEMA embraced social media use for recuperation, the office could give data concerning what kinds of individual help are accessible to individuals and family units, including how to apply for help, reporting application deadlines, and giving data and linkages to different offices and associations that give recovery help (Lindsay, 2011).

Aside from governments, social media giants are trying to improve their product to provide more aid to crisis response agencies. In his 2011 declaration, Fugate said he had met with agents from Apple, Craigslist, Facebook, Google, Microsoft and Twitter to proceed with the dialog on the most proficient method to “connect regularly, changing capacities of the computerized world to more readily serve people in general” (Lieberman, 2011). As a feature of the pivot toward including the public more in a disaster response, social media have adjusted to incorporate crisis related instruments. Facebook aids some crises related associations, including data frameworks for Information Systems for Crisis Response and Management (ISCRAM), the Humanitarian Free and Open Source Software (FOSS) Project, just as various colleges with disaster related projects (Magsino, 2009).

While social media evidently provides great benefits to disaster management, its features can be exploited and manipulated by groups with malicious intents. One of the fall backs of social media is the time it takes to verify information. For example, a climate alert given by the National Weather Service is for the most part seen by people in general as having a high level of validity yet confirmed sources of data on less familiar risks may not be considered as reliable compared to a similar data

transferred by a trusted government source (National Research Council, 2011). Issues with validity includes the trustworthiness of accounts, such as unpopular news accounts, or messages from users where it would take valuable time to verify their messages which could in turn delay the response to an event (Bird, 2012). Diaz et. al., study highlights the difference in reporting between different sized crisis managements organizations, where they noticed that smaller sized organizations struggled to deal with all the incoming messages in a timely manner due to the size of their team that allowed only a small portion of time to process incoming messages as it is an added task on top of their regular tasks. In addition, bias from media outlets affects the perception of their news by consumers, where their intentions would be questioned due to the biased history of the outlets which could prevent the spread, or the acceptance, of the information they share (Pine, 2018). For example, a survey of respondents to Queensland flooding found that seventy five percent utilized government or media Facebook pages, while the rest got their information from smaller accounts and groups which was found to have provided data that are not consistently accurate (Bird, 2012). One of the main concerns from disaster management and responders is the spread of misleading information by malicious groups, and mass spamming of messages to responding organizations and news outlets that leads to the spread of false information more rapidly as reliable outlets would have a hard time going through the mass information they received to process and send out an accurate message (Magsino, 2009). In addition, one fall back of social media is it allows terrorist groups to spread its messages and agendas through a spam of small fake accounts that takes time to detect by the security algorithms of said platforms (Magsino, 2009). Lastly, accessibility remains an issue in making sure accurate news, warning messages, and instructions reach out to all types of the general population, especially among the disabled and severely sick individuals (Magsino, 2009). However, there have been efforts by private organizations to come up with specialized frameworks that target the vulnerable groups.

Numerous researchers concentrating on the development in social media utilization during mass crises highlight the need to continually screen and react to changing data in social media streams. Some emergency responders, similar to the Los Angeles

Local group of fire-fighters (LAFD), examined by Latonero and Shklovski (2011), have demonstrated how this should be possible if resources are designated with a particular goal in mind.

Brian Humphrey, who is a paramedic-prepared fireman at the LAFD, had filled in as a PIO for 17 of his 24 years at the office as of the examination. Wired magazine composed that Humphrey is “without any help pulling the city's local group of fire-fighters into the Web 2.0 era” (Latonero, 2011). Humphrey’s aim for the future of social media in terms of emergency management is to have every individual from the general population be empowered with the technological way to transmit data about a fire, emergency, or disaster to crisis management experts. Interactivity is a way to a shared open connection among people and crisis management experts with frameworks of data check set up to encourage common trust. However, not all crisis management associations share Humphrey’s vision of social media’s usage for continuous interactivity and tuning in to the public (Latonero, 2011). For instance, FEMA states it has been utilizing Twitter “as a way to offer data about the organization's crucial, and point of view.” FEMA's purpose appears to focus more on the one-way dissemination model of media use.

The specially appointed and natural way by which social media messages are considered during events such as disaster shows a dynamic and flexible assessment process (Latonero, 2011). Besides this, there is a solid potential for PIOs to be overwhelmed by the amount and sorts of data. Emergency management and government-created social media tools can be better coordinated with user’s existing social media networks so an alternative wouldn’t be required during an occasion (National Research Council, 2011). One way to improve the consumption and utilizing social media as a way to manage disaster is through the improvement and support of local news agencies. Although news accounts specialized in reporting disaster incidents local to one area are not constantly sending out messages, due to the nature of their focus, their data can be an important asset for crisis responders, occasion organizers, affected individuals, journalists and the sensibly meeting group. Local people may know more about the geographic or social highlights of the affected region that could be helpful to those responding from outside the region

(Starbird K. , 2010). Starbird and Palen (2010) found that individuals were bound to re-tweet records of the individuals who were nearby to the incident areas, when local accounts sent out tweets (Starbird K. M., 2012). The future additionally shows a more prominent degree of trust in the aggregate knowledge and self-redressing conduct of social media users. Studies show that there was proliferation of rumors on Twitter in the wake of the Chilean earthquake in 2010, and specialists found that tweets containing false data were bound to be tested by local Twitterers who pointed out these false tweets (Starbird K. , 2010).

Social media can be utilized to some degree to spread data and get client input through user feedback via messages, wall posts, and surveys. Until now, this is the means by which most crisis management associations, including the FEMA, utilize social media (Magsino, 2009). However, the risk of technology failure, programmers, stalkers, viruses, flaming, ease of use issues, vulnerability of data quality, and data overload are still a major concern for most of the emergency managers (White, 2009). To counter that, a portion of similar techniques utilized by these advanced pioneers are under discussion for use at the government level: smartphone-friendly mobile versions of FEMA Sites to enable clients to get to data and request help and utilizing social media to encourage correspondence between people in general, first responders, volunteer gatherings, the private division, and all degrees of government. A social network specially designed for emergency purposes is advantageous as it can be better controlled and secured, but the challenge with that however is the nature of users using different social network systems, which would make it hard for organizations to utilize a specialized emergency social network system (White, 2009).

2.3 HUMAN BEHAVIOR IN DISASTERS

It is quite acceptable, and commonly agreed fact, that when individuals are exposed to certain stressful and traumatic situation, whether materialistic or psychological, they may exhibit and show, for various length of time, behavioural changes; the type and severity of such behaviour will depend on so many factors, e.g. age, gender,

educational level, life experience, social standard, genetic factors, the type and magnitude of stress, and other factors (SAMHSA, 2014). Many studies support the need for increased behavioral health services, particularly after a disaster. In the context of "human behaviour" HB that researches mention different aspects of the nature of such HB. For example some researches mention about HB in respect to "preparedness for disaster and emergencies at individual, community, and organizational levels" (Ejeta LT, 2015), while other researchers report about HB in terms of "specific psychological feelings, and even suffering" (Damienne Provitolo, 2011). In the setting of "preparedness for disaster", researchers mention that preparedness efforts focus on changing human behaviors in ways that reduce people's risk and increase their ability to cope with hazard consequences; such preparedness, they claim, could be more effective tools in mitigation (the growing incidence) of disaster risk and ameliorating their impacts. That is, to play more significant roles in disaster risk reduction. Furthermore, they have proposed, analysed, and discussed many theories in this context of HB (Ejeta LT, 2015). Their conclusions concerning such theories and models which were discussed have been applied predominantly to disease outbreaks and natural hazards, and information on their utility as guides to preparedness for man-made hazards is lacking. Hence, future studies related to behavior theories and models addressing preparedness need to target developing countries where disaster risk and the consequent need for preparedness is high. A need for additional work on demonstrating the relationship of variables and constructs, including more clearly articulating roles for mediating effects was also identified in this analysis (Ejeta LT, 2015).

However, to go deeper in this respect, researchers have mentioned that disaster preparedness is one of the basic components of disaster risk reduction. Preparedness identifies the steps necessary to increase the likelihood of avoiding or minimizing hazard effect consequences. Preparedness strategies are developing through hazard identification and mapping, vulnerability analysis and risk assessment (Gregory RC, 2006), with behavior change strategies being used to inform how the outcome of this process can translate into protective actions. Effective preparedness reduces vulnerability, increases mitigation level, enable timely and effective response to a

disaster event and so shortens the recovery period from a disaster, and increase community resilience (Gregory RC, 2006). Disaster and emergency preparedness efforts focus predominantly on human behaviors. Human behaviors derive from factors that range from people's risk perception to lessons from direct and indirect past experiences of disaster events and emergencies through to interaction between individuals and environments (Ejeta LT, 2015). These factors interact to influence the nature and level of people's disaster and emergency health preparedness level (Perry RW et al, 2008). It is also clear from these studies that people within a given area, and who thus generally face comparable levels of risk, differ with regard to the nature and level of their preparedness and how people make choices about how to manage that risk. These efforts focus on how past experiences can be encapsulated in variable whose influence on behavior can be empirically tested. For example, people's experience in successfully dealing with challenging events in the past can be captured using scores on a measure of self-efficacy (Ejeta LT, 2015). On the other hand, it is quite useful to mention in the context of "human behaviour to disasters" that many researchers have proposed a typology of behaviours observed during different catastrophic events, whether natural or technological in origin, and whether local or dispersed. They had constructed this typology not in accordance with the origin of the event but with respect to a time continuum: the pre-catastrophe phase, the catastrophe phase, and the impact phase (Ejeta LT, 2015). For these three dimensions, they had identified a variety of behaviours, some corresponding to distancing from the event, others on the contrary corresponding to coming into contact with it. They also had identified three properties common to all these behaviours: they were essentially non-traditional, they were not specific to a level of analysis (behaviours might take shape for individuals, families, groups or organizations), and that they were short-lived (Ejeta LT, 2015). Other researchers had found that those behavioural changes could emerge at individual and at society group levels (Damienne Provitolo, 2011). Researchers had demonstrated that one third individuals with significant exposure to a natural disaster develop behavioral health disorders (North CS, 2013). Furthermore, as is common following disasters, high rates of symptoms of depression, anxiety, and posttraumatic stress disorder can persist for months or years, creating a need to

expand services and outreach for mental health (Palinkas LA, 1993). In a previous study of behavioral health care and primary care integration, (Osofsky HJ, 2017) stated that 76% of individuals who screened positive for post-traumatic stress disorder had a history of natural disaster exposure. The majority of patients in that study were female, consistent with the present findings (Osofsky HJ, 2017). Even more than this, (Lai BS, 2020) had found that in certain international disasters, participants, from both genders, with mild female predominance, had reported violence victimization and sexual assaults during disaster; consequently they suffered moderate- to-severe mental distress, and even suicidal ideation, more than participants without history of violence. Disaster-exposed youth endorsed high levels of violence victimization and negative health correlates. Earthquake survivors who experience violence were more likely to report negative health correlates. Greater attention to downstream sequelae of natural disasters is needed (Lai BS, 2020). Furthermore, researchers have found another human behavior psychological upset, which is grief. Grief is a near universal reaction following ecological disasters and occurs in response to profound loss. Losses include not only of loved family or friends but also of one's home and cherished mementos, such as photographs and items handed down from previous generations. Those who are displaced can also lose their community and its support, comfort with familiar surroundings, pets, and their usual life routines. Individuals and families in evacuation centers and shelters can also lose their sense of safety and security, home comforts, and the restoration that comes with routine sleep. Traumatic grief increases the likelihood of adverse mental health outcomes (Joshua C. Morganstein., 2020), (Kristensen P, 2014).

3. DATA AND METHOD

3.1 INTRODUCTION

After the underlying pursuit of the literature, all sources that includes articles, blog entries and reports considering the title, seemed applicable to our point of intrigue were analyzed further. Eventually, we held sources that (i) simply tended to disasters and (ii) included social media. Our operationalization of disaster included natural disaster comprises for example, hurricanes, tornadoes, floods, earthquakes, droughts and wildfires and man-made disasters, for example, acts of terrorism, yet did exclude authoritative emergencies, (for example, the Arab Spring), or continuous clashes, (for example, civil or political wars).

In this section, all the methods and techniques used in this study are mentioned. The numbers and results of the questions carried out within the data and method of the research, the data collection tools, data analysis methods, research questions and hypothesis were discussed.

3.2 CONSIDERATIONS AND LIMITATIONS OF THE STUDY

Since the nature of the study concerns people's and public's behaviour before, during, or after the occurrence of natural or man-made disaster, which may occur or touch their life, therefore, the "Questionnaire" and "Type of Questions" were designed and presented to the various categories of peoples. Furthermore, rather than solid material things, the study addresses the society individuals, regarding important and essential matters like their psychological and spiritual reactions before, during, or after the possible disaster inflicting loss of lives, body wounds, or material damages, their use of various digital technology tools, and which means of communication(s) they may find most convenient and appropriate to use depending on their experience and skills in using those devices.

The conduct of the study had met few difficulties and limitations, e.g.,

- a. Linguistic difficulties of translation, Arabic, English, and Turkish.
- b. The interruption in the internet services in Iraq during distributions period of the survey because of demonstrations in that time.

- c. It is possible that the answers and reactions of those people, who participated in the current study, may be not as specific and realistic as those who had actually suffered the disasters and their sequelae!
- d. Obviously, the current study has included in its questionnaire people who know how to use the "Internet of Things" well. However, since there are many society members who do not know how to use these technical digital services, the internet in its many forms and programs, but had actually suffered the experience of disaster, at one stage of their life, e.g., earthquakes, floods, explosions, those people have not been included in the study, and their opinions have not been explored; therefore such exclusion may add to the limitations of this study.

3.3 RESEARCH APPROACH

There are mainly two kinds of research approaches **deductive** and **inductive**; both approaches are completely different from each other. Understanding of both approaches is essential to support the choice of appropriate research approach.

- a. Deductive research approach is associated with the positivism paradigm; it allows the research to establish a hypothesis by using theory. Various steps: development of theory, hypothesis, observation through data and information and confirmation. Those varieties of data and information are collected by the researcher to confirm or reject the hypothesis to resolve issue (Gill J., 2010).

Theory → Hypothesis → Observation → Confirmation.

- b. Inductive research approach is associated with inter-pretivism; it is totally reverse form deductive approach. Observation, pattern, tentative hypothesis and theory are important steps of the inductive approach.

Observation → Pattern → Tentative Hypothesis → Theory.

In the current study, the deductive approach of methodology is utilized dependent on existing writing and an online survey utilized to gather the information. Because of that, the deductive methodology is most suitable approach to the current study.

3.4 THE SAMPLING METHOD AND SURVEY DESIGN

3.4.1 Sampling Method of the Research

Sampling technique is characterized as the procedure or system through which a sample is chosen from the population (Siverman D., 2014). There are two types of sampling:

1. **The probability sampling:** this technique includes the stratified sampling method. i.e. simple random sampling method.
2. **The non-probability sampling:** this technique includes convenience sampling, snow ball sampling, quota sampling and judgmental sampling.

The sampling method which is time saving and less costly is **convenience sampling method** which is normally followed in the empirical investigation because of its substantial benefits. As, it is not easy to collect the data from each observation of the population and costly for the research to collect the required data thereof, convenience sampling method allows the researcher to collect the data conveniently and easily from the selected sample size who had qualified for the study. An online questionnaire survey is one of those convenient ways to approach responders and collect data, along these lines. The sample size for the present study is 352 participants; they were asked to respond to an online questionnaire; the sample included people from both sexes, their ages range from 17- above 45 years, they came from different countries, and held different educational levels.

3.4.2 Survey Design

The frameworks of the research design give a structure where the relationship of selected variables for the examination is determined (Cooper D.R., 2010). However, since in the "Qualitative Research" methodology comprises an in depth interview, open ended questions and interviews that are used to collect the data (Saunders, 2010), on the other hand the "Quantitative Research" is a methodology focuses on gathering numerical data and generalizing it across group of people or to explain a particular phenomenon. (Babbie E.R., 2010). The current study has adopted the "Quantitative Research" strategy; a cohort study encompassed participants from Turkey, Iraq, and other countries, exploring their opinions and experience regarding human behaviour, and their use of social media and IoT in the management of disaster.

The survey questions are divided into four parts:

The first part contained nine questions. The questions would provide demographic information's about responders, e.g. gender, age, educational background, time spent on social media sites, and if they had faced or experienced any kind of disaster or taken disaster management courses).

The second part contained seven questions about IoT technology; this part would provide information about usage of this technology by responders and would test their acknowledgment about it.

The third part was about social media usages. This section was divided into three parts (before, during, and after disaster); each part has six to seven questions; this section would provide information about using of social media application throughout the three phases of the disaster.

The forth part was about human behavior reaction; it was, again, divided into three parts (before, during, after disaster); each part contained seven questions; these questions would test human behavior reactions during the three phases of disaster.

All responses from various categories questions, a total of 61 questions, were reviewed, tabulated, and analyzed in order to get the results. Then the results underwent statistical analysis, and discussed; then conclusions and recommendations

extracted and documented. (See below please copy of the survey from page no.118 to 125.

3.5 DATA COLLECTION

In the current study research, the survey technique was used to obtain the data. The survey was carried out within 6 months, stretching from June 2019 to November 2019. The survey form "questionnaire form" was distributed online and also by hand. The online questionnaire were created on Google form and printed through a word document. The Google form link was distributed to different people around the world but most specifically to the people of Turkey and Iraq. Similarly, the print form of survey was distributed among the Bahcesehir University students and their family member who were easily accessible. However, the online questionnaire provides more easy way to the researcher for collecting the data that will be processed to prove or dismiss the presumed hypothesis.

3.6 DATA ANALYSIS

When all the survey was finished, a deductive quantitative approach had been used to test hypothesis. In the current survey the questionnaires had been scaled using Likert scale for human behavior parts; the options were defines as not at all = 1, a little bit = 2, moderately =3, quite a bit = 4, a d extremely = 5.

The data obtained in the study were analyzed using Excel and SPSS program 22.0 version. Descriptive statistical methods (number, percentages, average, and standard deviation) were used when evaluating the data. In the comparison between the groups' variables, to find differences, Paired Sample T-Test and Independent Sample T-Test tests were used. The findings were evaluated at 95% confidence interval and 5% significance level. In data analysis, statistical techniques such as means were used. The relations between variables of the study were tested by Cross Tabulation, and by applying Pearson correlation analysis, the correlation relationship between the scales is given in table no.3.1.

Table 3.1: Correlation relationship between scales

Pearson correlation (R)	Relationship level
0,00 – 0,25	Very Weak
0,26 – 0,49	Weak
0,50 – 0,69	Middle
0,70 – 0,99	Good or (Strong)
0,90 – 1,00	Very Good or (Strong)

3.7 SURVEY QUESTIONS RESULTS

In this section, results of the questionnaires that were performed during the period from June-2019 – November 2019, have been organized and presented in tables. Although the total participants were 352; the first 141 participants had answered the questionnaire draft given to them; however, the other 211 participants answered the questionnaire draft after having added few questions, please see the tables in the results. The questions in the questionnaire draft have been mentioned within the titles of the tables.

3.7.1 Personal Information of the Participants Tables

In this section, demographic data of the participants who were involved in the study, such as gender, age, educational level, country, residency, experience duration and time spent on social media, and whether the participants had faced real disaster or not, what kind of disaster they had experienced, and whether they had attended any disaster management courses, have been shown (Tables from 3.2 to 3.12).

Table 3.2: Gender

Gender	Number	Percentage (%)	Valid Percentage	Cumulative Percentage
Females	115	32.7%	32.7%	32.7%
Males	217	61.6%	61.6%	94.3%
Prefer not to mention	20	5.7%	5.7%	100%
Total	352	100%	100%	-

As is seen in table 3.2 the results show that the number of female participants were 115 (32.7 percentage), males were 217 (61.6 percentage), however, 20 (5.7 percentage) of the participants preferred not to mention their gender.

Table 3.3: Age Groups

Age in years	Number	Percentage (%)	Valid Percent	Cumulative Percent
17-24	161	45.7%	45.7%	45.7%
25-31	55	15.6%	15.6%	61.4%
32-38	41	11.6%	11.6%	73%
39-45	65	18.5%	18.5%	91.5%
46 and above	30	8.5%	8.5%	100%
Total	352	100%	100%	-

As is seen in table 3.3 the results show that the age groups of participants, in years, and their percentages as follow: 17-24 (45.7 percentage), 25-31 (15.6 percentage), 32-38 (11.6 percentage), 39-45 (18.5 percentage), while 30 participants were (8.5 percentage) 46 years and above.

Table 3.4: Educational level

Educational level	Number	Percentage (%)	Valid Percent	Cumulative Percent
Read and write only	1	0.3%	0.3%	0.3%
High school	21	6.0%	6.0%	6.3%
University	225	63.9%	63.95	70.2%
Master or higher	105	29.8%	29.8%	100%
Total	352	100%	100%	-

As seen in table 3.4 the results show the educational level of participants as follow: those holding a master's degree or a higher degree were 105 (29.8 percentage) in number, those holding a university degree 225 (63.9 percentage), high school qualification 21 (6 percentage), while only one of the participants could read and write (0.3 percentage).

Table 3.5: Country

Country	Number	Percentage (%)	Valid percent	Cumulative percent
Turkey	105	29.8%	49.8%	49.8%
Iraq	88	25.0%	41.7%	91.5%
Other countries	18	5.1%	8.5%	100%
Total	211	59.9%	100%	-
Participants didn't answer this question	141	40.1%		-
Total	352	100%	-	-

Note: This question wasn't included in the first questionnaire draft of the survey.

As seen in table 3.5 the results show that there were no mention of "country" from 141 (40.1 percentage) participants as this question was not included in the first draft of the survey; however, they were as follow: 105 (29.8 percentage) from Turkey, 88 (25.0 percentage) from Iraq, and 18 (5.1 percentage) came from different countries.

Table 3.6: Residency

Residency	Number	Percentage (%)	Valid Percent	Cumulative Percent
Rural inhabitant (House)	72	20.5%	20.5%	20.5%
Rural inhabitant (Building)*	60	17%	17%	37.5
Rural inhabitant (Campus)	8	2.3%	2.3%	39.8%
Urban inhabitant (House)	99	28.1%	28.1%	76.9%
Urban inhabitant (Building)*	107	30.4%	30.4%	98.3%
Urban inhabitant (Campus)	6	1.7%	1.7%	100%
Total	352	100%	100%	

Building= Multi-storey residential building.*

As seen in table 3.6 the results show that 72 (20.5 percentage) of participations are living in Rural-inhabitant (House), 60 (17 percentage) living in rural-inhabitant (Building), 8 (2.3 percentage) living in rural-inhabitant (Campus), 99 (28.1 percentage) living in urban-inhabitant (House), 107 (30.4 percentage) living in urban-inhabitant (Building), and 6 (1.7 percentage) living in urban-inhabitant (Campus).

Table 3.7: Time spending on social media

Numbers of hours spending on social media sites per day	Number	Percentage (%)	Valid Percentage	Cumulative Percentage
0-1 Hour	52	14.8%	14.8%	14.8%
2-3 Hours	152	43.2%	43.2%	58.0%
4-5 Hours	68	19.3%	19.3%	77.3%
More than 6 hours	29	8.2%	8.2%	85.5%
It depends on the need	51	14.5%	14.5%	100%
Total	352	100%	100%	-

As seen in table 3.7 the results show that (14.8 percentage) of participants spend 0-1 hour on social media sites, (43.2 percentage) spend around 2-3 hours, (19.3 percentage) spend 4-5 hours, (8.2 percentage) answered that they spent more than 6 hours, and 51 (14.5 percentage) said that using social media sites depend on the need and their time.

Table 3.8: Since when did you start using social media?

Period time started using social media	Number	Percentage (%)	Valid Percent	Cumulative Percent
3-6 months	4	1.1%	1.1%	1.1%
1-2 years	16	4.5%	4.5%	5.7%
3-4 years	45	12.8%	12.8%	18.5%
More than 5 years	287	81.5%	81.5%	100%
Total	352	100%	100%	-

As seen in table 3.8 the results show that the number of participants started using social media 3-6 months were 4 (1.1 percentage), 1-2 years were 16 (4.5 percentage), 3-4 years were 45 (12.8 percentage), and more than 5 years 286 (81.5 percentage).

Table 3.9: Have you ever experienced or have been part of any kind of disasters?

Faced Natural or Man - made disasters	Number	Percentage (%)	Valid Percent	Cumulative Percent
No	46	13.1%	21.8%	21.8%
I don't remember	10	2.8%	4.7%	26.5%
Yes	155	44%	73.5%	100%
Total	211	59.9%	100%	-

Participants didn't answer this question	141	40.1%	-	-
Total	352	100%	-	-

Note: This question wasn't included in the first questionnaire draft of the survey.

As seen in table 3.9 the results show that there was no reply to this question (of having seen or being involved in any disaster) from 141 (40.1 percentage) participants as this question was not included in the first draft of the survey; however, those who had answered were as follow: 46 (13.1 percentage) answered with No, 10 (2.8 percentage) don't remember, and 155 (44 percentage) answered Yes.

Table 3.10: If Yes, What kind of natural disasters you have experienced?

Kind of natural disaster	Number of participants didn't choose this option	Responses		
		Number of participants who chose this option	Percentage (%)	User Percentage
Tornadoes and severe storms	195	16	7.8%	10.3%
Hurricanes and tropical storms	203	8	3.9%	5.1%
Floods	170	41	20%	26.4%
Wildfires	204	7	3.4%	4.5%
Earthquakes	90	121	59%	78%
Drought	207	4	2%	2.5%
Others	203	8	3.9%	5.1%
Total	-	205	100%	131.9%

Note1: This question wasn't included in the first draft of the survey that was answered by 141 (40.1%) participants.

Note2: Question with note (You can choose more than one option).

*Note3: In this table, the user percentages were counted as following: the number of the selected option divided by the total number of the participants multiplied by 100 (N/Total of N * 100).*

As seen in table 3.10 the results show that number of participants who answered this question was (205) of the total participants; they were allowed to choose more than one option; the final results were 16 (10.3 percentage) answered Tornadoes and severe storms, 8 (5.1 percentage) answered Hurricanes and tropical storms, 41 (26.4 percentage) answered Floods, 7 (4.5 percentage) answered Wildfires, 121(78 percentage) answered Earthquakes, 4 (2.5 percentage) answered Drought, 8 (5.1 percentage) answered Other.

Table 3.11: If Yes, What kind of man-made disasters you have experienced?

Kind of Man-made disaster	Number of participants didn't choose this option	Responses		
		Number of participants who chose this option	Percentage (%)	User Percentage
Hazardous material spills	207	5	2.4%	3.2%
Fires	187	25	12%	16.1%
Groundwater contamination	200	12	5.7%	7.7%
Transportation accidents	165	47	22.5%	30.3%
Structure failures	202	10	4.8%	6.4%
Mining accidents	204	8	3.8%	5.1%
Explosions	170	42	20.1%	27%
Act of terrorism	163	49	23.4%	31.6%
Others	200	11	5.3%	7%
Total	-	209	100%	134.4%
<i>Note1: This question wasn't included in the first draft of the survey that was answered by 141 (40.1%) participants.</i>				
<i>Note2: Question with note (You can choose more than one option).</i>				
<i>Note3: In this table, the user percentages were counted as following: the number of the selected option divided by the total number of the participants multiplied by 100 ($N/\text{Total of } N * 100$).</i>				

As seen in table 3.11 the results show that number of participants who answered this question was (209) of the total participants; they were allowed to choose more than one option; the final results were 5 (3.2 percentage) answered Hazardous material spills, 25 (16.1 percentage) answered Fires, 12 (7.7 percentage) answered Groundwater contamination, 47 (30.3 percentage) answered Transportation accidents, 10 (6.4 percentage) answered Structure failures, 8 (5.1 percentage) answered Mining accidents, 42 (27 percentage) answered Explosions, 49 (31.6 percentage) answered Act of terrorism, 11(7 percentage) answered Others.

Table 3.12: Did you take any disaster management program in your school, college or office?

Did you take any disaster management program in your school, college or office?	Number	Percentage (%)	Valid Percent
No	136	38.6%	64.5%
Yes	75	21.3%	35.5%
Total	211	59.9%	100%
Participants didn't answer this question	141	40.1%	-
Total	352	100%	-
<i>Note: This question wasn't included in the first questionnaire draft of the survey.</i>			

As seen in table 3.12 the results show that 141(40.1 percentage) did not answer this question because it was not included in the first questionnaire draft of the survey. Those who had answered this question were 211(59.9 percentage) of the total participants; they answered as follow: 136(38.6 percentage) answered No, 75(21.3 percentage) answered Yes.

3.7.2 The IoT Results Tables

Table 3.13: Is the internet service available efficiently and continuously on your country?

The question in the title of the table	Number	Percentage (%)	Valid Percent	Cumulative Percent
No	40	11.4%	11.4%	11.4%
Sometimes	104	29.5%	29.5%	40.9%
Yes	208	59.1%	59.1%	100%
Total	352	100%	100%	-

Regarding the answers to the question of table 3.13, whether the internet service is available efficiently and continuously on your country, 40 (11.4 percentage) participants answered No, 104 (29.5 percentage) answered Sometimes, and 208 (59.1 percentage) answered Yes.

Table 3.14: Is infrastructure for IoT is available in your city?

The question in the title of the table	Number	Percentage (%)	Valid Percent	Cumulative Percent
No	63	17.9%	17.9%	17.9%
I have no idea	181	51.4%	51.4%	69.3%
Yes	108	30.7%	30.7%	100%
Total	352	100%	100%	-

Regarding the availability of an infrastructure for the IoT, question of table 3.14, 63 (17.9 percentage) participants answered No, 181 (51.4 percentage) answered I have no idea, and 108 (30.7 percentage) answered Yes.

Table 3.15: Do you use internet network to learn about weather news and conditions?

The question in the title of the table	Number	Percentage (%)	Valid Percent	Cumulative Percent
No	10	2.8%	2.8%	2.8%
Sometimes	74	21.0%	21.0%	23.9%
Yes	268	76.1%	76.1%	100%
Total	352	100%	100%	-

Regarding the answers to the question of table 4.7.2.3, 10 (2.8 percentage) participants answered No, 74 (21.0 percentage) answered Sometimes, 268 (76.1 percentage) answered Yes.

Table 3.16: IoT creates positive attitudes to reduce disaster consequence?

The question in the title of the table	Number	Percentage (%)	Valid Percent	Cumulative Percent
Disagree	14	4.0%	4.0%	4%
I have no idea	144	40.9%	40.9%	44.9%
Agree	194	55.1%	55.1%	100%
Total	352	100%	100%	-

Regarding the answers to the question of table 3.16, 14 (4.0 percentage) participants answered Disagree, 144 (40.9 percentage) answered I have no idea, 194 (55.1 percentage) answered Agree that IoT creates positive attitudes to reduce disaster consequences.

Table 3.17: IoT sensors may be having negative effect on people health?

The question in the title of the table	Number	Percentage (%)	Valid Percent	Cumulative Percent
Disagree	92	26.1%	26.1%	26.1%
I have no idea	166	47.2%	47.2%	73.3%
Agree	94	26.7%	26.7%	100%
Total	352	100%	100%	-

Regarding the answers to the question of table 3.17, 92 (26.1 percentage) participants answered Disagree, 166 (47.2 percentage) answered I have no idea, 94 (26.7 percentage) answered Agree that IoT sensors may be having negative effect on people health.

Table 3.18: IoT increases productivity of social media?

The question in the title of the table	Number	Percentage (%)	Valid Percent	Cumulative Percent
Disagree	15	4.3%	4.3%	4.3%
I have no idea	136	38.6%	38.6%	42.9%
Agree	201	57.1%	57.1%	100%
Total	352	100%	100%	-

Regarding the answers to the question of table 3.18, 15 (4.3 percentage) participants answered Disagree, 136 (38.6 percentage) answered I have no idea, 201 (57.1 percentage) answered Agree that IoT increases productivity of social media.

Table 3.19: Are you going to use IoT technology to control your home equipment?

The question in the title of the table	Number	Percentage (%)	Valid Percent	Cumulative Percent
No	49	13.9%	13.9%	13.9%
Maybe in the future	243	69.0%	69.0%	83.0%
I used it already	60	17.0%	17.0%	100%
Total	352	100%	100%	-

Regarding the answers to the question of table 3.19, whether participants were going to use IoT technology to control their home equipment, it shows that 49 (13.9

percentage) participants answered No, 243(69.0 percentage) answered Maybe in the future, 60(17.0 percentage) answered I used it already.

3.7.3 Social Media Results Parts

3.7.3.1 Social Media Questions Results (Before Disaster) Tables

Table 3.20: Which type of mobile applications would you favor to use to communicate with your relatives or friends frequently?

The question in the title of the table	Number of participants who didn't chose this option	Responses		
		Number of participants who chose this option	Percentage (%)	User Percentage
Twitter	270	82	8.7%	23.2%
Facebook	196	156	16.5%	44.3%
Instagram	145	207	21.9%	58.8%
WhatsApp	51	301	31.8%	85.5%
Snapchat	282	70	7.4%	19.8%
Skype	320	32	3.4%	9%
Viber	287	65	6.9%	18.4%
Other	319	33	3.5%	9.3%
Total	-	946	100%	268.3%

Note1: Question with note (You can choose more than one option).
Note2: In this table, the user percentages were counted as following: the number of the selected option divided by the total number of the participants multiplied by 100 ($N/\text{Total of } N * 100$).

Concerning the mobile applications preferred to be used by the applicants, table 3.20 shows that the number of participants who chose Twitter were 82 (23.2 percentage), Facebook 156 (44.3 percentage), Instagram 207 (58.8 percentage), WhatsApp 301 (85.5 percentage), Snapchat 70 (19.8 percentage), Skype 32 (9 percentage), Viber 65 (18.4 percentage), Other 33 (9 percentage).

Table 3.21: Which mobile application do you prefer to use it first?

The question in the title of the table	Number of participants who chose this option	Percentage (%)	Valid Percent
Twitter	14	4.0%	6.6%
Facebook	72	20.5%	34.1%
Instagram	9	2.6%	4.3%
WhatsApp	95	27.0%	45.0%
Skype	12	3.4%	5.7%
Viber	9	2.6%	4.3%
Total	211	59.9%	100%
No. of participant who didn't answer this question	141	40.1%	-
Total	352	100%	-

Note: This question wasn't included in the first questionnaire draft of the survey.

Concerning the preference in using mobile application first, table 3.21 shows that the number of participants chose Twitter 14 (6.6 percentage), Facebook 72 (34.1 percentage), Instagram 9 (4.3 percentage), WhatsApp 95 (45 percentage), Skype 12 (5.7 percentage), and only 9 (4.3 percentage) participants chose Viber.

Table 3.22: Which communication methods do you prefer to receive news frequently?

The question in the title of the table	Number of participants who didn't chose this option	Responses		
		Number of participants who chose this option	Percentage (%)	User Percentage
Social media	61	291	42.5%	82.6%
TV	200	152	22.3%	43.1%
Radio	301	51	7.5%	14.4%
SMS mobile	286	66	9.6%	18.7%
Siren	335	17	2.5%	4.8%
Newspaper	325	27	3.9%	7.6%
Webpages	275	77	11.3%	21.8%
Other	349	3	0.4%	0.8%
Total	-	684	100%	193.8%

Note1: Question with note (You can choose more than one option).
Note2: In this table, the user percentages were counted as following: the number of the selected option divided by the total number of the participants multiplied by 100 ($N/\text{Total of } N * 100$).

Regarding answering the question of table 3.22, it shows that the number of participants who chose Social media were 291 (82.6 percentage), TV 152 (43.1 percentage), Radio 51 (14.4 percentage), SMS mobile 66 (18.7 percentage), Siren 17 (4.8 percentage), Newspaper 27 (7.6 percentage), Webpages 77 (21.8 percentage), and Other 3(0.8 percentage).

Table 3.23: Which option would you like to use to communicate with your relatives or friends frequently?

The question in the title of the table	Number of participants who didn't chose this option	Responses		
		Number of participants who chose this option	Percent (%)	User Percentage
Mobile call	77	275	40.2%	78.1%
SMS	251	101	14.8%	28.6%
Personal message on social media	94	258	37.7%	73.2%
Public post on social media	305	47	6.9%	13.3%
Other	349	3	0.4%	0.8%
Total	-	684	100%	194%

Note1: Question with note (You can choose more than one option).
*Note2: In this table, the user percentages were counted as following: the number of the selected option divided by the total number of the participants multiplied by 100 (N/Total of N * 100).*

Table 3.23 shows that the number of participants who chose Mobile call were 275 (78.1 percentage), SMS 101 (28.6 percentage), Personal message on social media 258 (73.2 percentage), Public post on social media 47 (13.3 percentage), Other 3 (0.8 percentage).

Table 3.24: If you hear that a natural disaster will hit your living area will you search on the Internet for different precautionary measures?

The question in the title of the table	Number	Percentage (%)	Valid Percent	Cumulative Percent
No	5	1.4%	1.4%	1.4%
Maybe	105	29.8%	29.8%	31.3%
Yes	242	68.8%	68.8%	100%
Total	352	100%	100%	-

Table 3.24 shows that 5 (1.4 percentage) answered No, 105 (29.8 percentage) answered Maybe, and 242 (68.8 percentage) answered Yes they would search the internet for different precautionary measures.

Table 3.25: Do you provide any disaster precautionary measures on social media?

The question in the title of the table	Number	Percentage (%)	Valid Percent	Cumulative Percent
No	123	34.9%	34.9%	34.9%
Maybe	134	38.1%	38.1%	73.0%
Yes	95	27.0%	27.0%	100%
Total	352	100%	100%	-

Table 3.25 shows 123 (34.9 percentage) answered No, 134 (38.1 percentage) answered Maybe, and 95 (27.0 percentage) answered Yes.

Table 3.26: Do you think that you will receive any disaster warning from social media?

The question in the title of the table	Number	Percentage (%)	Valid Percent	Cumulative Percent
No	45	12.8%	12.8%	12.8%
Maybe	145	41.2%	41.2%	54.0%
Yes	162	46.0%	46.0%	100%
Total	352	100%	100%	-

Table 3.26 shows that 45 (12.8 percentage) answered No, 145 (41.2 percentage) answered Maybe, and 162 (46.0 percentage) answered Yes they would receive disaster warning via social media.

3.7.3.2 Social Media Questions Results (During Disaster) Tables

Table 3.27: Which device do you use it to log on social media during disaster?

The question in the title of the table	Number of participants who didn't chose this option	Responses		
		Number of participants who chose this option	Percentage (%)	User Percentage
Mobile device	16	336	66.4%	95.4%
Tablet	313	39	7.7%	11%

Laptop	257	95	18.8%	26.9%
Desktop computer	320	32	6.3%	9%
Other	348	4	0.8%	1.1%
Total	-	506	100%	143.4%

Note1: Question with note (You can choose more than one option).

*Note2: In this table, the user percentages were counted as following: the number of the selected option divided by the total number of the participants multiplied by 100 (N/Total of N * 100).*

Table 3.27 shows that the number of participants who chose Mobile device were 336 (95.4 percentage), Tablet 39 (11 percentage), Laptop 95 (26.9 percentage), Desktop computer 32 (9 percentage), Other 4 (1.1 percentage).

Table 3.28: Which option would you like to use to communicate with your relatives or friends during the disaster?

The question in the title of the table	Number of participants who didn't chose this option	Responses		
		Number of participants who chose this option	Percentage (%)	User Percentage
Mobile call	46	307	42.5%	87.2%
SMS	220	131	18.1%	37.2%
Personal message on social media	142	210	29.1%	59.6%
Public post on social media	282	70	9.7%	19.8%
Other	348	4	0.6%	1.1%
Total	-	722	100%	204.9%

Note1: Question with note (You can choose more than one option).

*Note2: In this table, the user percentages were counted as following: the number of the selected option divided by the total number of the participants multiplied by 100 (N/Total of N * 100).*

Table 3.28 shows that the number of participants who chose Mobile call were 307 (87.2 percentage), SMS 131 (37.2 percentage), Personal message on social media 210 (59.6 percentage), Public post on social media 70 (19.8 percentage), Other 4 (1.1 percentage).

Table 3.29: Which type of mobile applications would you favor to use to communicate with your relatives or friends at this event?

The question in the title of the table	Number of participants who didn't chose this option	Responses		
		Number of participants who chose this option	Percentage (%)	User Percentage
Twitter	299	53	7%	15%
Facebook	219	134	17.7%	38%
Instagram	215	137	18%	38.9%
WhatsApp	49	302	39.8%	85.7%
Snapchat	306	46	6.1%	13%
Skype	342	10	1.3%	2.8%
Viber	300	52	6.9%	14.7%
Other	328	24	3.2%	6.8%
Total	-	758	100%	214.9%

Note1: Question with note (You can choose more than one option).

Note2: In this table, the user percentages were counted as following: the number of the selected option divided by the total number of the participants multiplied by 100 ($N/\text{Total of } N * 100$).

Table 3.29 shows that the number of participants who chose Twitter was 53 (15 percentage), Facebook 134 (38 percentage), Instagram 137 (38.9 percentage), WhatsApp 302 (85.7 percentage), Snapchat 46 (13%), Skype 10 (2.8 percentage), Viber 52 (14.7 percentage), Other 24 (6.8 percentage).

Table 3.30: Which mobile application do you prefer to use it first?

The question in the title of the table	Number of participants who chose this option	Percentage (%)	Valid Percent
Twitter	8	2.3%	3.8%
Facebook	87	24.7%	41.2%
Instagram	1	0.3%	0.5%
WhatsApp	105	29.8%	49.8%
Viber	10	2.8%	4.7%
Total	211	59.9%	100%
No. of participant who didn't answer this question	141	40.1%	-
Total	352	100%	-

Note: This question wasn't included in the first questionnaire draft of the survey.

Table 3.30 shows that the number of participants who chose Twitter 8 (3.8 percentage), Facebook 87 (41.2 percentage), Instagram 1 (0.5 percentage), WhatsApp 105 (49.8 percentage), Viber 10 (4.7 percentage).

Table 3.31: Will you send or receive request for help or assistance on social media?

The question in the title of the table	Number	Percentage (%)	Valid Percent	Cumulative Percent
No	36	10.2%	10.2%	10.2%
Maybe	156	44.3%	44.3%	54.5%
Yes	160	45.5%	45.5%	100%
Total	352	100%	100%	-

Table 3.31 shows 36 (10.2 percentage) of participants answered No, 155 (44.1 percentage) answered Maybe, and 161 (45.7 percentage) answered Yes.

Table 3.32: Will you try to document and know what is happening on social media during the disaster?

The question in the title of the table	Number	Percentage (%)	Valid Percentage	Cumulative Percentage
No	47	13.4%	13.4%	13.4%
Maybe	132	37.5%	37.5%	50.9%
Yes	173	49.1%	49.1%	100%
Total	352	100%	100%	-

Table 3.32 shows 47 (13.4 percentage) of participants answered No, 132 (37.5 percentage) answered Maybe, and 173 (49.2 percentage) answered Yes.

Table 3.33: Will you try to inform others about one's own condition and location and learn about a disaster-affected individual's condition and location by using social media?

The question in the title of the table	Number	Percentage (%)	Valid Percentage	Cumulative Percentage
No	19	5.4%	5.4%	5.4%
Maybe	132	37.5%	37.5%	42.9%
Yes	201	57.1%	57.1%	100%
Total	352	100%	100%	-

Table 3.33 shows 19 (5.4 percentage) of participants answered No, 132 (37.5 percentage) answered Maybe, and 201 (57.1 percentage) answered Yes.

4.7.3.3 Social Media Questions Results (After Disaster) Tables

Table 3.34: Which option would you like to use to communicate with your relatives or friends after the disaster?

The question in the title of the table	Number of participants who didn't chose this option	Responses		
		Number of participants who chose this option	Percentage (%)	User Percentage
Mobile call	41	311	41.3%	88.3%
SMS	204	148	19.7%	42%
Personal message on social media	133	219	29.1%	62.2%
Public post on social media	282	70	9.3%	19.8%
Other	347	5	0.7%	1.4%
Total	-	753	100%	213.7%

Note1: Question with note (You can choose more than one option).
*Note2: In this table, the user percentages were counted as following: the number of the selected option divided by the total number of the participants multiplied by 100 (N/Total of N * 100).*

Table 3.34 shows that the number of participants who chose Mobile call were 311 (88.3 percentage), SMS 148 (42 percentage), Personal message on social media 219 (62.2 percentage), Public post on social media 70 (19.8 percentage), Other 5 (1.4 percentage).

Table 3.35: Which type of mobile applications would you favor to use to communicate with your relatives or friends after the event?

The question in the title of the table	Number of participants who didn't chose this option	Responses		
		Number of participants who chose this option	Percentage (%)	User Percentage
Twitter	287	65	8.2%	18.4%
Facebook	207	145	18.3%	41.1%
Instagram	199	153	19.3%	43.4%
WhatsApp	62	291	36.7%	82.6%
Snapchat	309	42	5.3%	11.9%

Skype	339	13	1.6%	3.6%
Viber	294	58	7.3%	16.4%
Other	327	25	3.2%	7.1%
Total	-	792	100%	224.5%

Note1: Question with note (You can choose more than one option).

Note2: In this table, the user percentages were counted as following: the number of the selected option divided by the total number of the participants multiplied by 100 ($N/\text{Total of } N * 100$).

Table 3.35 shows that the number of participants who chose Twitter was 65 (18.4 percentage), Facebook 145 (41.1 percentage), Instagram 153 (43.4 percentage), WhatsApp 291 (82.6 percentage), Snapchat 42 (11.9 percentage), Skype 13 (3.6 percentage), Viber 58 (16.4 percentage, Other 25 (7.1%).

Table 3.36: Which mobile application do you prefer to use it first?

The question in the title of the table	Number of participants who chose this option	Percentage (%)	Valid Percentage
Twitter	6	1.7%	2.8%
Facebook	88	25.0%	41.7%
WhatsApp	111	31.5%	52.6%
Instagram	2	0.6%	0.9%
Viber	4	1.1%	1.9%
Total	211	59.9%	100%
No. of participant who didn't answer this question	141	40.1%	
Total	352	100%	-

Note: This question wasn't included in the first questionnaire draft of the survey.

Table 3.36 shows that the number of participants who chose Twitter 6 (2.8 percentage), Facebook 88 (41.7 percentage), WhatsApp 111 (52.6 percentage), Instagram 2 (0.9 percentage), and 4 (1.9 percentage) chose Viber.

Table 3.37: Will you try to help rescue teams by sending reports or videos or pictures on social media?

The question in the title of the table	Number	Percentage (%)	Valid Percentage	Cumulative Percentage
No	28	8.0 %	8.0%	8.0%
Maybe	153	43.5%	43.5%	51.4%
Yes	171	48.6%	48.6%	100%
Total	352	100%	100%	-

Table 3.37 shows 28 (8.0 percentage) of participants answered No, 153 (43.5 percentage) answered Maybe, and 171 (48.6 percentage) answered Yes to helping rescue teams by sending reports or videos or pictures on social media.

Table 3.38: Will you use social media to spread information about affected or rescue places?

The question in the title of the table	Number	Percentage (%)	Valid Percentage	Cumulative Percentage
No	26	7.4%	7.4%	7.4%
Maybe	143	40.6%	40.6%	48.0%
Yes	183	52.0%	52.0%	100%
Total	352	100%	100%	-

Table 3.38 shows 26 (7.4 percentage) of participants answered No, 143 (40.6 percentage) answered Maybe, and 183 (52.0 percentage) answered Yes.

Table 3.39: Will you Provide and receive information about (and discuss) disaster response, recovery, and rebuilding; tell and hear stories about the disaster on social media?

The question in the title of the table	Number	Percentage (%)	Valid Percent	Cumulative Percent
No	24	6.8%	6.8%	6.8%
Maybe	144	40.9%	40.9%	47.7%
Yes	184	52.3%	52.3%	100%
Total	352	100%	100%	-

Table 3.39 shows 24 (6.8 percentage) of participants answered No, 144 (40.9 percentage) answered Maybe and 184 (52.3 percentage) answered Yes that they would discuss all 3 phases of disaster.

Table 3.40: Would you prefer to raise and develop awareness of an event; donate and receive donations; identify and list ways to help or volunteer on social media?

The question in the title of the table	Number	Percentage (%)	Valid Percentage	Cumulative Percentage
No	24	6.8%	6.8%	6.8%
Maybe	151	42.9%	42.9%	49.7%
Yes	177	50.3%	50.3%	100%
Total	352	100%	100%	-

Table 3.40 shows 24 (6.8 percentage) of participants answered No, 151 (42.9 percentage) answered Maybe, and 177 (50.3 percentage) answered Yes that they would acquire an active and positive attitude during the disaster.

Table 3.41: Will you try to document or inform people or give advice or follow the news at that time on social media?

The question in the title of the table	Number	Percentage (%)	Valid Percent	Cumulative Percent
No	24	6.8%	6.8%	6.8%
Maybe	142	40.3%	40.3%	47.2%
Yes	186	52.8%	52.8%	100%
Total	352	100%	100%	-

Participants answering question of table 3.41; 24 (6.8 percentage) of them answered No, 142 (40.3 percentage) answered Maybe, and 186 (52.8 percentage) answered Yes to documenting or informing people or giving advice or following the news at that time on social media.

3.7.4 Human Behavior Questions Results Tables

3.7.4.1 Human Behavior Questions Results (Before Disaster) Tables

Table 3.42: Will you get worried as you hear a stressful event is happening soon?

The question in the title of the table	Number	Percentage (%)	Valid Percent	Cumulative Percent
Not at all	33	9.4%	9.4%	9.4%
A little bit	94	26.7%	26.7%	36.1%
Moderately	116	33.0%	33.0%	69.0%
Quite a bit	75	21.3%	21.3%	90.3%
Extremely	34	9.7%	9.7%	100%
Total	352	100%	100%	-

Table 3.42 question whether participants get worried on hearing a disaster going to happen, the table shows that 33 (9.4 percentage) of participants answered Not at all, 94 (26.7 percentage) answered A little bit, 116 (33.0 percentage) answered Moderately,

and 75 (21.3 percentage) answered Quite a bit, and 34 (9.7 percentage) answered Extremely getting worried.

Table 3.43: Do you feel very emotionally upset when something reminded you of the stressful event?

The question in the title of the table	Number	Percentage (%)	Valid Percentage	Cumulative Percentage
Not at all	45	12.8%	12.8%	12.8%
A little bit	102	29.0%	29.0%	41.8%
Moderately	110	31.3%	31.3%	73.0%
Quite a bit	67	19.0%	19.0%	92.0%
Extremely	28	8.0%	8.0%	100%
Total	352	100%	100%	-

Table 3.43 shows 45 (12.8 percentage) of participants answered Not at all, 102 (29.0 percentage) answered A little bit, 110 (31.3 percentage) answered Moderately, 67 (19.0 percentage) answered Quite a bit, and 28 (8.0 percentage) answered Extremely felt emotionally upset when reminded of a stressful event.

Table 3.44: Do you feel like you are detached or distant from yourself, your body, your physical surroundings or your memories?

The question in the title of the table	Number	Percentage (%)	Valid Percent	Cumulative Percent
Not at all	83	23.6%	23.6%	23.6%
A little bit	103	29.3%	29.3%	52.8%
Moderately	107	30.4%	30.4%	83.2%
Quite a bit	43	12.2%	12.2%	95.5%
Extremely	16	4.5%	4.5%	100%
Total	352	100%	100%	-

However, whether a participant would feel detached or distant from himself, body, surrounding, or memories, question in table 3.44, the answers disclose that 83 (23.6 percentage) of participants answered Not at all, 103 (29.3 percentage) answered A little bit, 107 (30.4 percentage) answered Moderately, 43 (12.2 percentage) answered Quite a bit, and 16 (4.5 percentage) answered Extremely.

Table 3.45: Do you try to avoid thoughts, feelings, or physical sensations that reminded you of the stressful event?

The question in the title of the table	Number	Percentage (%)	Valid Percent	Cumulative Percent
Not at all	42	11.9%	11.9%	11.9%
A little bit	96	27.3%	27.3%	39.2%
Moderately	110	31.3%	31.3%	70.5%
Quite a bit	77	21.9%	21.9%	92.3%
Extremely	27	7.7%	7.7%	100%
Total	352	100%	100%	-

Table 3.45 shows 42 (11.9 percentage) of participants answered Not at all, 96 (27.3 percentage) answered A little bit, 110 (31.3 percentage) answered Moderately, 77 (21.9 percentage) answered Quite a bit, and 27 (7.7 percentage) answered Extremely.

Table 3.46: Being "super alert," on guard, or constantly on the lookout for danger?

The question in the title of the table	Number	Percentage (%)	Valid Percent	Cumulative Percent
Not at all	54	15.3%	15.3%	15.3%
A little bit	85	24.1%	24.1%	39.5%
Moderately	127	36.1%	36.1%	75.6%
Quite a bit	58	16.5%	16.5%	92.0%
Extremely	28	8.0%	8.0%	100%
Total	352	100%	100%	-

Table 3.46 shows that 54 (15.3 percentage) of participants answered Not at all, 85 (24.1 percentage) answered A little bit, 127 (36.1 percentage) answered Moderately, 58 (16.5 percentage) answered Quite a bit, and 28 (8.0 percentage) answered Extremely being "super alert," on guard, or constantly on the lookout for danger.

Table 3.47: Do you feel jumpy or easily startled when you hear an unexpected noise?

The question in the title of the table	Number	Percentage (%)	Valid Percent	Cumulative Percent
Not at all	67	19.0%	19.0%	19.0%
A little bit	103	29.3%	29.3%	48.3%
Moderately	100	28.4%	28.4%	76.7%
Quite a bit	58	16.5%	16.5%	93.2%
Extremely	24	6.8%	6.8%	100%
Total	352	100%	100%	-

Table 3.47 shows 67 (19.0 percentage) of participants answered Not at all, 103 (29.3 percentage) answered A little bit, 100 (28.4 percentage) answered Moderately, 58 (16.5 percentage) answered Quite a bit, and 24 (6.8 percentage) answered Extremely.

Table 3.48: Do you get extremely irritable or angry at any point where you scream on other people, get into fights, or destroyed things?

The question in the title of the table	Number	Percentage (%)	Valid Percent	Cumulative Percent
Not at all	114	32.4%	32.4%	32.4%
A little bit	79	22.4%	22.4%	54.8%
Moderately	87	24.7%	24.7%	79.5%
Quite a bit	45	12.8%	12.8%	92.3%
Extremely	27	7.7%	7.7%	100%
Total	352	100%	100%	-

Table 3.48 shows 114 (32.4 percentage) of participants answered Not at all, 79 (22.4 percentage) answered A little bit, 87 (24.7 percentage) answered Moderately, 45 (12.8 percentage) answered Quite a bit, and 27 (7.7 percentage) answered Extremely.

3.7.4.2 Human Behavior Questions Results (during disaster) Tables

Table 3.49: Are your worries about the event reaching the degree of panic attack?

The question in the title of the table	Number	Percentage (%)	Valid Percent	Cumulative Percent
Not at all	106	30.1%	30.1%	30.1%
A little bit	84	23.9%	23.9%	54.0%
Moderately	98	27.8%	27.8%	81.8%
Quite a bit	39	11.1%	11.1%	92.9%
Extremely	25	7.1%	7.1%	100%
Total	352	100%	100%	-

Table 3.49 concerning worries reach degree of panic attack, answers show that 106 (30.1 percentage) of participants answered Not at all, 84 (23.9 percentage) answered A little bit, 98 (27.8 percentage) answered Moderately, 39 (11.1 percentage) answered Quite a bit, and 25 (7.1 percentage) felt Extremely.

Table 3.50: Feeling very emotionally upset when you are experiencing the traumatic event?

The question in the title of the table	Number	Percentage (%)	Valid Percent	Cumulative Percent
Not at all	48	13.6%	13.6%	13.6%
A little bit	103	29.3%	29.3%	42.9%
Moderately	106	30.1%	30.1%	73.0%
Quite a bit	60	17.0%	17.0%	90.1%
Extremely	35	9.9%	9.9%	100%
Total	352	100%	100%	-

Table 3.50 shows that 48 (13.6 percentage) of participants answered Not at all, 103 (29.3 percentage) answered A little bit, 106 (30.1 percentage) answered Moderately, 60 (17.0 percentage) answered Quite a bit, and 35 (9.9 percentage) feel Extremely emotionally upset when experience a traumatic event.

Table 3.51: Feeling detached or distant from yourself, your body, your physical surroundings, or your memories?

The question in the title of the table	Number	Percentage (%)	Valid Percent	Cumulative Percent
Not at all	72	20.5%	20.5%	20.5%
A little bit	105	29.8%	29.8%	50.3%
Moderately	112	31.8%	31.8%	82.1%
Quite a bit	40	11.4%	11.4%	93.5%
Extremely	23	6.5%	6.5%	100%
Total	352	100%	100%	-

Table 3.51 shows 48 (13.6 percentage) of participants answered Not at all, 103 (29.3 percentage) answered A little bit, 106 (30.1 percentage) answered Moderately, 60 (17.0 percentage) answered Quite a bit, and 35 (9.9 percentage) answered Extremely.

Table 3.52: Trying to avoid thoughts, feelings, or physical sensations that you're experiencing during the stressful event?

The question in the title of the table	Number	Percentage (%)	Valid Percentage	Cumulative Percentage
Not at all	46	13.1%	13.1%	13.1%
A little bit	93	26.4%	26.4%	39.5%
Moderately	123	34.9%	34.9%	74.4%
Quite a bit	63	17.9%	17.9%	92.3%
Extremely	27	7.7%	7.7%	100%
Total	352	100%	100%	-

Trying avoiding thoughts and sensation that were experienced during a disaster, question in Table 3.52, answers have shown that 46 (13.1 percentage) of participants answered Not at all, 93 (26.4 percentage) answered A little bit, 123 (34.9 percentage) answered Moderately, 63 (17.9 percentage) answered Quite a bit, and 27 (7.7 percentage) tried Extremely.

Table 3.53: Being "super alert," on guard, or constantly on the lookout for danger?

The question in the title of the table	Number	Percentage (%)	Valid Percent	Cumulative Percent
Not at all	39	11.1%	11.1%	11.1%
A little bit	82	23.3%	23.3%	34.4%
Moderately	130	36.9%	36.9%	71.3%
Quite a bit	62	17.6%	17.6%	88.9%
Extremely	39	11.1%	11.1%	100%
Total	352	100%	100%	-

Table 3.53 shows 39 (11.1 percentage) of participants answered Not at all, 82 (23.3 percentage) answered A little bit, 130 (36.9 percentage) answered Moderately, 62 (17.6 percentage) answered Quite a bit, and 39 (11.1 percentage) stated Extremely super alert and constantly on the lookout for danger.

Table 3.54: Feeling jumpy or easily startled when you hear an unexpected noise?

The question in the title of the table	Number	Percentage (%)	Valid Percentage	Cumulative Percentage
Not at all	51	14.5%	14.5%	14.5%
A little bit	88	25.0%	25.0%	39.5%
Moderately	112	31.8%	31.8%	71.3%
Quite a bit	64	18.2%	18.2%	89.5%
Extremely	37	10.5%	10.5%	100%
Total	352	100%	100%	-

Table 3.54 shows 51 (14.5 percentage) of participants answered Not at all, 88 (25.0 percentage) answered A little bit, 112 (31.8 percentage) answered Moderately, 64 (18.2 percentage) answered Quite a bit, and 37 (10.5 percentage) answered Extremely.

Table 3.55: Being extremely irritable or angry to the point where you yelled at other people, got into fights, or destroyed things?

The question in the title of the table	Number	Percentage (%)	Valid Percentage	Cumulative Percentage
Not at all	100	28.4%	28.4%	28.4%
A little bit	83	23.6%	23.6%	52.0%
Moderately	95	27.0%	27.0%	79.0%
Quite a bit	51	14.5%	14.5%	93.5%
Extremely	23	6.5%	6.5%	100%
Total	352	100%	100%	-

Regarding the question of table 3.55, answers show that 100 (28.4 percentage) of participants answered Not at all, 83 (23.6 percentage) answered A little bit, 95 (27.0 percentage) answered Moderately, 51 (14.5 percentage) answered Quite a bit, and 23 (6.5 percentage) stated that they became Extremely irritable, angry, yelled at people or even got into fight or destroyed things.

3.7.4.3 Human Behavior Questions Results (after disaster) Tables

Table 3.56: Having “flashbacks,” that is, you suddenly acted or felt as if a stressful experience from the past was happening all over again (for example, you re-experienced parts of a stressful experience by seeing, hearing, smelling, or physically feeling parts?

The question in the title of the table	Number	Percentage (%)	Valid Percentage	Cumulative Percentage
Not at all	64	18.2%	18.2%	18.2%
A little bit	117	33.2%	33.2%	51.4%
Moderately	111	31.5%	31.5%	83.0%
Quite a bit	41	11.6%	11.6%	94.6%
Extremely	19	5.4%	5.4%	100%
Total	352	100%	100%	-

Table 3.56 regarding having flashbacks from the event, answers show that 64 (18.2 percentage) of participants answered Not at all, 117 (33.2 percentage) answered A

little bit, 111 (31.5 percentage) answered Moderately, 41 (11.6 percentage) answered Quite a bit, while 19 (5.4 percentage) answered Extremely.

Table 3.57: Feeling very emotionally upset when something reminded you of a stressful experience?

The question in the title of the table	Number	Percentage (%)	Valid Percentage	Cumulative Percentage
Not at all	50	14.2%	14.2%	14.2%
A little bit	110	31.3%	31.3%	45.5%
Moderately	104	29.5%	29.5%	75.0%
Quite a bit	63	17.9%	17.9%	92.9%
Extremely	25	7.1%	7.1%	100%
Total	352	100%	100%	-

Table 3.56 shows 50 (14.2 percentage) of participants answered Not at all, 110 (31.3 percentage) answered A little bit, 104 (29.5 percentage) answered Moderately, 63 (17.9 percentage) answered Quite a bit, and 25 (7.1 percentage) answered Extremely emotionally upset when reminded of the stressful event.

Table 3.58: Feeling detached or distant from yourself, your body, your physical surroundings, or your memories?

The question in the title of the table	Number	Percentage (%)	Valid Percentage	Cumulative Percentage
Not at all	86	24.4%	24.4%	24.5%
A little bit	104	29.5%	29.5%	54.0%
Moderately	112	31.8%	31.8%	85.8%
Quite a bit	37	10.5%	10.5%	96.3%
Extremely	13	3.7%	3.7%	100%
Total	352	100%	100%	-

Table 3.58 shows that 86 (24.4 percentage) of participants answered Not at all, 104 (29.5 percentage) answered A little bit, 112 (31.8 percentage) answered Moderately, 37 (10.5 percentage) answered Quite a bit, and 13 (3.7 percentage) answered Extremely detached and distant from themselves, bodies, surroundings, and memories.

Table 3.59: Trying to avoid thoughts, feelings, or physical sensations that reminded you of a stressful experience?

The question in the title of the table	Number	Percentage (%)	Valid Percent	Cumulative Percent
Not at all	54	15.3%	15.3%	15.3%
A little bit	97	27.6%	27.6%	42.9%
Moderately	102	29.0%	29.0%	71.9%
Quite a bit	66	18.8%	18.8%	90.6%
Extremely	33	9.4%	9.4%	100%
Total	352	100%	100%	-

Table 3.59 shows 54 (15.3 percentage) of participants answered Not at all, 97 (27.6 percentage) answered A little bit, 102 (29.0 percentage) answered Moderately, 66 (18.8 percentage) answered Quite a bit, and 33 (9.4 percentage) answered Extremely trying to avoid thoughts, feelings, or physical sensations that reminded them of a stressful experience.

Table 3.60: Being "super alert," on guard, or constantly on the lookout for danger?

The question in the title of the table	Number	Percentage (%)	Valid Percent	Cumulative Percent
Not at all	62	17.6%	17.6%	17.6%
A little bit	92	26.1%	26.1%	43.8%
Moderately	117	33.2%	33.2%	77.0%
Quite a bit	53	15.1%	15.1%	92.0%
Extremely	28	8.0%	8.0%	100%
Total	352	100%	100%	-

Whether being "super alert," on guard, or constantly on the lookout for danger, table 3.60 question, answers show that 62 (17.6 percentage) of participants answered Not at all, 92 (26.1 percentage) answered A little bit, 117 (33.2 percentage) answered Moderately, 53 (15.1 percentage) answered Quite a bit, and 28 (8.0 percentage) answered Extremely super alert.

Table 3.61: Feeling jumpy or easily startled when you hear an unexpected noise?

The question in the title of the table	Number	Percentage (%)	Valid Percent	Cumulative Percent
Not at all	77	21.9%	21.9%	21.9%
A little bit	107	30.4%	30.4%	52.3%
Moderately	83	23.6%	23.6%	75.9%
Quite a bit	56	15.9%	15.9%	91.8%
Extremely	29	8.2%	8.2%	100%
Total	352	100%	100%	-

Table 3.61 shows 77 (21.9 percentage) of participants answered Not at all, 107 (30.4 percentage) answered A little bit, 83 (23.6 percentage) answered Moderately, 56 (15.9 percentage) answered Quite a bit, and 29 (8.2 percentage) feel Extremely jumpy when hear an unexpected noise.

Table 3.62: Being extremely irritable or angry to the point where you yelled at other people, got into fights, or destroyed things?

The question in the title of the table	Number	Percentage (%)	Valid Percentage	Cumulative Percentage
Not at all	114	32.4%	32.4%	32.4%
A little bit	80	22.7%	22.7%	55.1%
Moderately	79	22.4%	22.4%	77.6%
Quite a bit	52	14.8%	14.8%	92.3%
Extremely	27	7.7%	7.7%	100%
Total	352	100%	100%	-

Table 3.62 shows 114 (32.4 percentage) of participants answered Not at all, 80 (22.4 percentage) answered A little bit, 79 (22.4 percentage) answered Moderately, 52 (14.8 percentage) answered Quite a bit, and 27 (7.7 percentage) stated that they become Extremely irritable or angry to the point that they yelled at other people got into fights, or even had destroyed things.

4.8 NORMAL DISTRIBUTION TEST OF THE DATA

The “Normal Distribution” curve it’s the symmetrical, bell-shaped distribution of data. (Michael H. & Gordon T., 2003). Since the "Human Behaviour" (HB) data of the current study, when tested, have complied with the "normal frequency distribution", i.e. the bell shape, it has been applied.

Table 3.63: Normal distribution tests of the human behaviors data

Test of Normality					
Variables	N	Skewness		Kurtosis	
		Statistic	Std. ** Error	Statistic	Std. Error
HB* Before	352	0.139	0.130	-0.385	0.259
HB* During	352	.102	.130	-.408	.259
HB* After	352	.245	.130	-.415	.259
HB* Before	141	.169	.204	.199	.406
HB* After	141	.310	.204	-.027	.406
HB* Before	211	.191	.167	-.670	.333
HB* After	211	.235	.167	-.695	.333
<i>HB*: Human behaviour. Std. Error**: Standard deviation.</i>					

Skewness and Kurtosis are statistical tools that are widely used as a measure of the normal distribution of data. While the harmonious positions of the data are measured with Skewness, however, peak positions can be measured by Kurtosis. (West et al., 1996) proposed that "normal distribution" of the data has maximum Skewness (proper) value > 2 and Kurtosis (proper) value > 7 . All the values are in the range of Skewness and Kurtosis scales; this means that they have normal distribution. In the same way, histogram and P-P plot also show the residual data are normally distributed.

Figure 3.1: Histogram distribution and Normal Q-Q Plot distribution of human behaviour before disaster; results of 352 responders

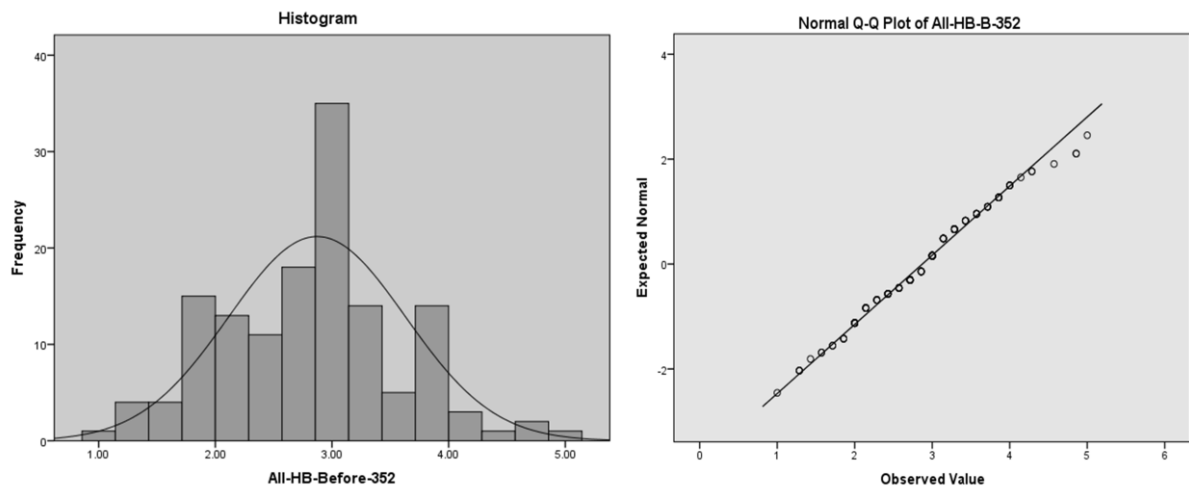


Figure 3.2: Histogram distribution and Normal Q-Q Plot distribution of human behaviour during disaster; results of 352 responders

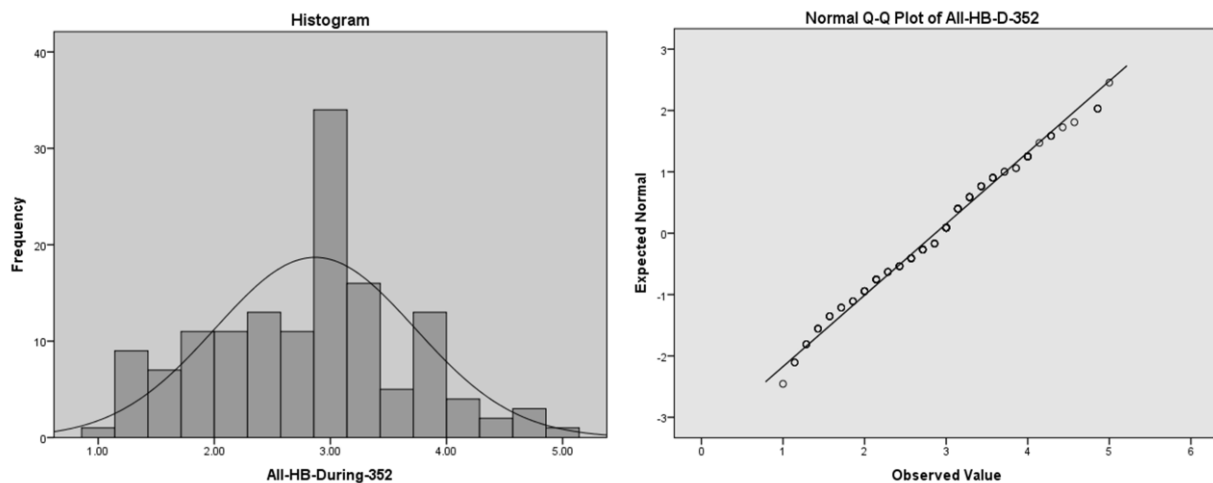


Figure 3.3: Histogram distribution and Normal Q-Q Plot distribution of human behaviour after disaster; results of 352 responders

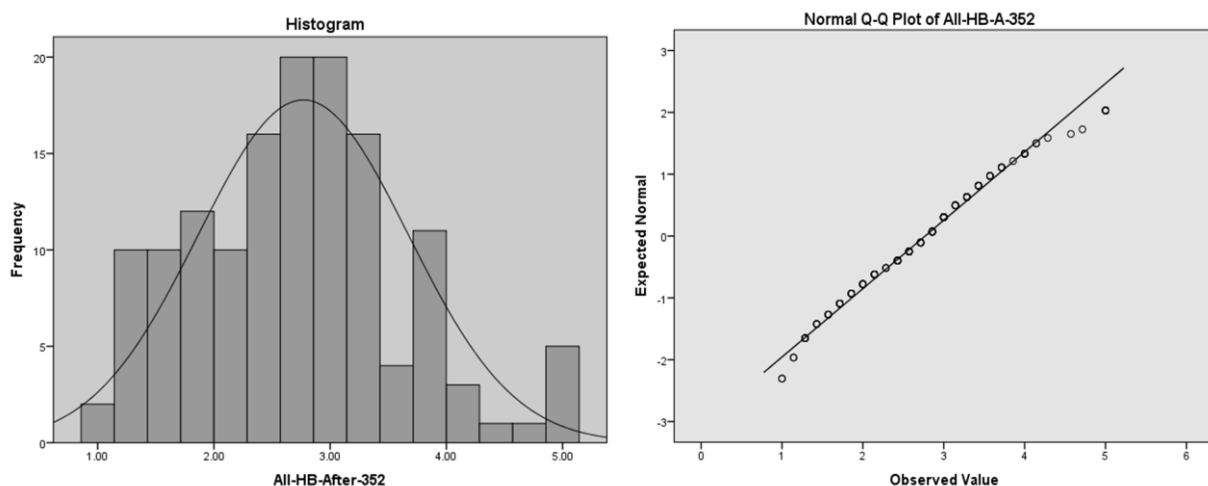


Figure 3.4: Histogram distribution and Normal Q-Q Plot distribution of human behaviour before disaster; results of 211 responders

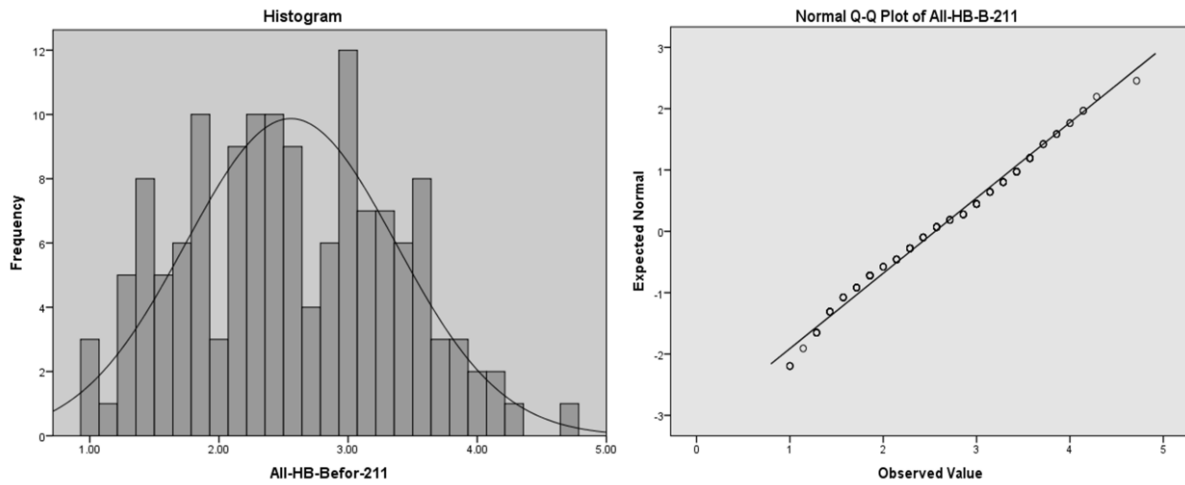


Figure 3.5: Histogram distribution and Normal Q-Q Plot distribution of human behaviour after disaster; results of 211 responders

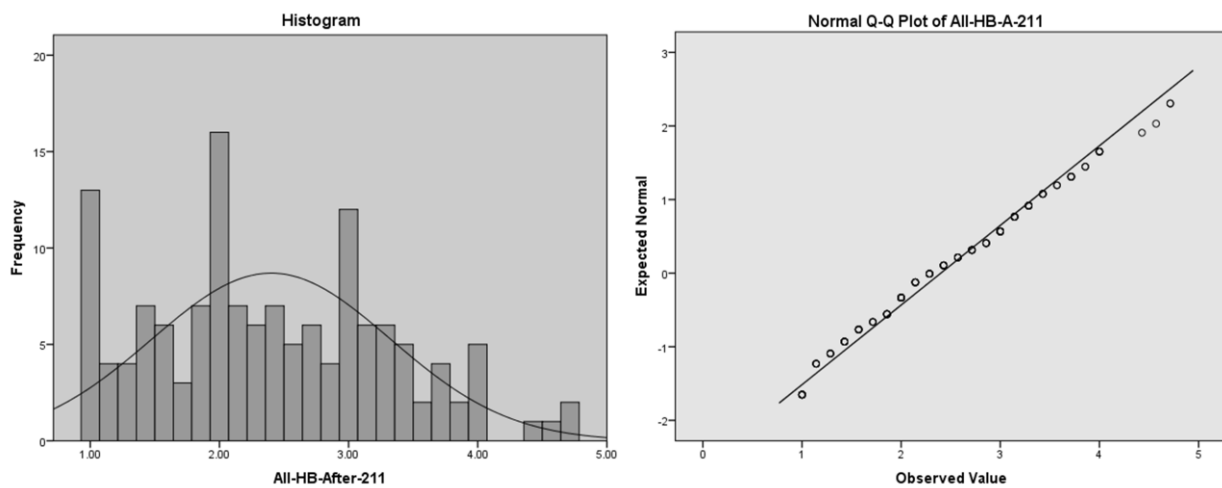


Figure 3.6: Histogram distribution and Normal Q-Q Plot distribution of human behaviour before disaster; results of 141 responders

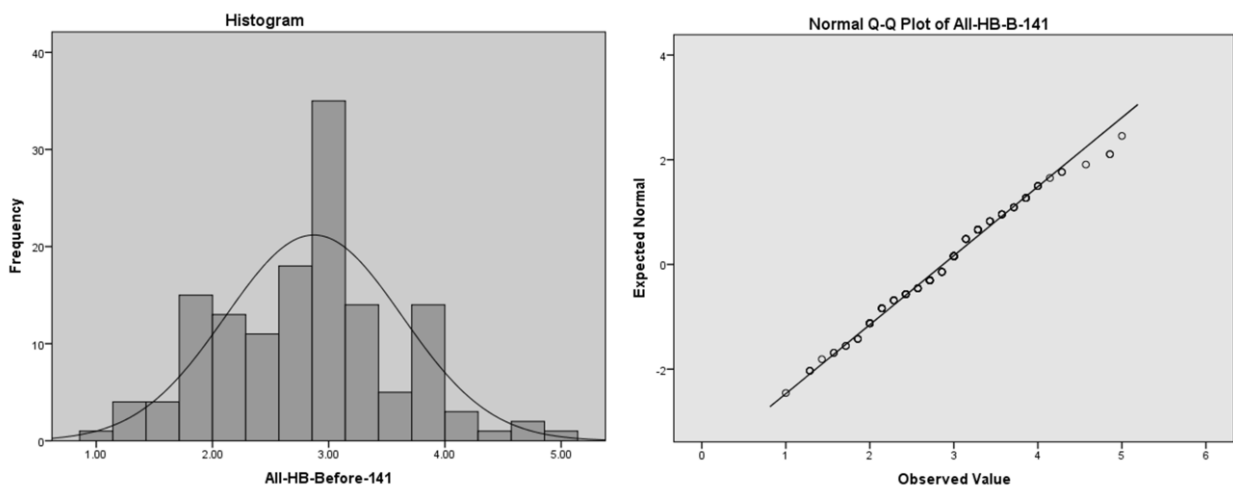
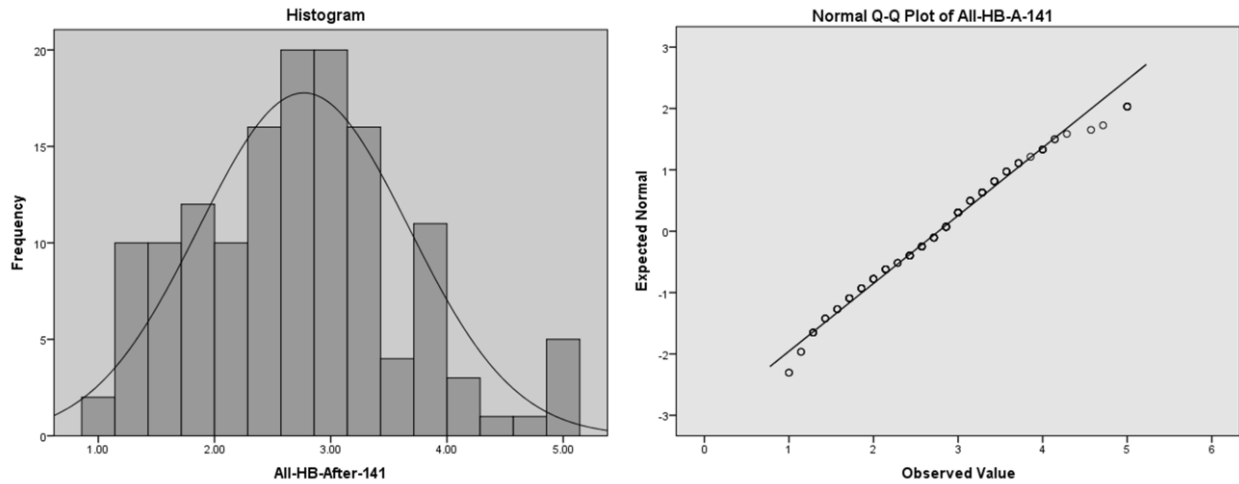


Figure 3.7: Histogram distribution and Normal Q-Q Plot distribution of human behaviour before disaster; results of 141 responders

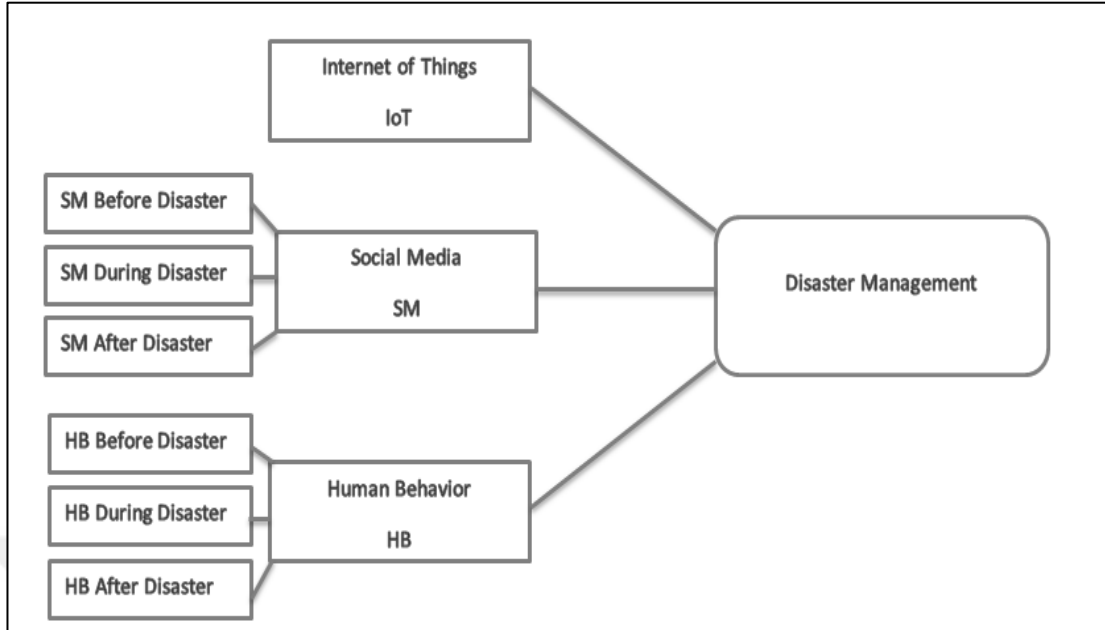


4.9 CONCEPTUAL FRAMEWORK AND HYPOTHESIS ANALYSIS

The conceptual framework has been developed based on theoretical approaches and an empirical investigation which has been deeply explained in literature review chapter.

In this study we aimed to minimize disaster threat and showed the role of the internet (IoT, Social media) that would be using throughout the three phases of disaster (before, during, and after). Moreover, the current study investigated the emotional and psychological effects of the disaster (before, during, and after its occurrence) on human behavior.

Figure 3.8: Conceptual framework of the study



In the current study ten hypotheses have been assumed (**H 1-9**). Furthermore, in the first hypothesis the comparison in human behaviour between before and after disaster has been denoted **A**, while that between before and during the disaster has been denoted **B**.

In the third hypothesis the comparison in human behavior between (before part-141 before earthquake participants (**first copy of the survey**) & before part-211 after earthquake participants (**second copy of the survey**) has been denoted **A**, while that between (after part-141 before earthquake participants (**first copy of the survey**) and after part-211 after earthquake participants (**second copy of the survey**) has been denoted **B**.

H1.A There is a difference in human behaviors in terms of their emotional felling (Getting worried, feeling upset, being extremely angry) before and after disaster occurrence (Total number of participants in the survey was 352).

H1.B There is a difference in human behaviors in terms of their emotional felling (Getting worried, feeling upset, being extremely angry) before and during disaster occurrence (Total number of participants in the survey was 352).

H2 There is a correlation between human behaviors before, during and after a disaster occurs.

Important Note: For the hypothesis No. H.3 (A, B) the data of the survey divided into two parts depended on the event (earthquake that hit Istanbul on the 26th of September, 2019 at 13:59 pm and measured 5.8 on Richter scale).

First part: The data that were collected from June until 25 of September; there were (141 participants)

Second part: The data that were collected from 26 of September until end of November; there were (211 participants).

Moreover, the test on the human behavior, data before and after earthquake and each part was divided into 3 parts: before, during, and after disaster occurrence.

H3.A There is a difference in human behaviors that can be observed as expressed by the participants in terms of their emotional felling (Getting worried, feeling upset, being extremely angry). Before part questions (Number of participants were 141) and after part questions (Number of participants were 211).

H3.B There is a difference in human behaviors that can be observed as expressed by the participants in terms of their emotional felling (Getting worried, feeling upset, being extremely angry). After part questions (Number of participants were 141), and before part questions (Number of participants were 211).

H4. Using of social media applications during disaster event could be different from country to another.

H5 Citizens in general prefer to communicate with their relatives and friends using mobile call more than social media applications in all the stages of disaster.

H6 There is a relation between spending time on social media sites and gender type.

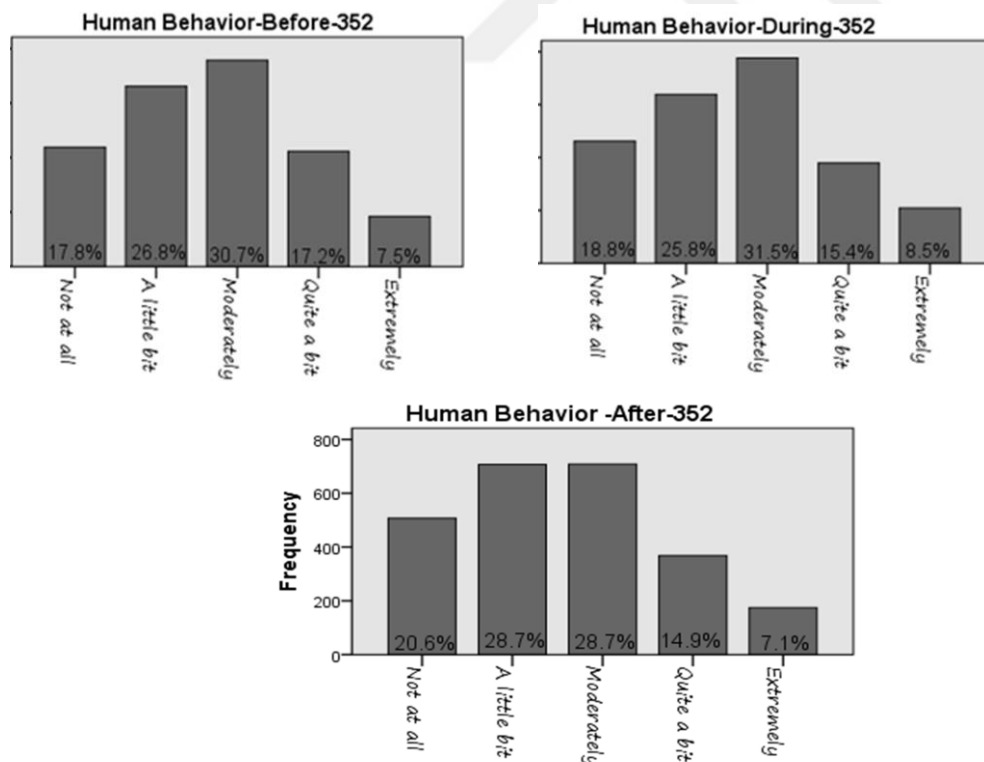
H7 Younger generation is more likely to spend time on social media sites than middle age group generation.

H8 There is correlation between time spending on social media sites and the education level.

H9 There is a relation between using IoT technology and age levels. (Young generations are more likely to use IoT technology than middle age generations).

H1.A There is a difference in human behaviors in terms of their emotional felling (Getting worried, feeling upset, being extremely angry) before and after disaster occurrence (Total number of participants in the survey was 352).

Figure 3.9: Bar histogram of the frequency results data of human behaviour throughout stages of disaster, before, during, and after event; total number of participants was 352



In figure 3.9 the results of the seven questions of each group are combined together depended on which option was chosen by the participants. To get these percentages, it is obvious that there is a variation in proportions between three groups in the human behavior questionnaire about participant's feelings and reactions in case a disaster occur. Moreover, to test this hypothesis, Paired Sample *t*-Test will be applied to prove the hypothesis as the data of the current study comply with those statistical tools.

The Paired Sample *t*-Test is parametric test for comparing two means that are from the same individual, object, or related unites, and has normal distribution (KentState University library, 2020).

Table 3.64: Paired sample statistics results for human behavior groups before and after-352 data

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Human behavior-Before	2.6968	352	.80530	.04292
	Human behavior-After	2.5921	352	.92512	.04931
<i>M*</i> = Mean (Sum of observed value divided by the number of observations).					
<i>SD**</i> = Standard Deviation (A measure of the spread of score a way from mean).					

Table 3.64 shows that total numbers for two groups were 352; the score of mean and standard deviation for group "before disaster" was 2.696, 0.805 respectively, while the score of mean and standard deviation for the group "during disaster" was 2.592, 0.925 respectively.

Table 3.65: Paired sample correlations results for human behavior groups before and after-352 data

Paired Samples Correlations				
		N	Correlation	Sig.
Pair 1	Human behavior-Before & Human behavior-After	352	.697	.000

Table 3.65 shows the paired sample correlation results between the two groups were ($r = 0.697$).

Table 3.66: Paired sample test results for human behavior groups before and after-352 data

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed) = P^*
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	HB-Before – HB-After	.10471	.68239	.03637	.03317	.17624	2.879	351	.004
HB: Human Behavior									
Sig=P*= The P value gives the probability of any observed difference having happened by chance.									

Table 3.66 shows the paired samples *t*-test results reading from the left to the right:

Means = Give the average difference between two means variables (2.6968-2.5921=0.10471).

Std.Deviation =
$$\sigma = \sqrt{\frac{1}{N} \sum_{i=1}^N (x_i - \mu)^2}$$

Give the standard deviation of the difference scores = 0.68239

Standard error mean is the standard error (standard deviation divided by the square root of the sample size) = 0.03637

t: The test statistic (denoted *t*) for the paired *t*-test = 2.879 and it had been computed as following:

Figure 3.10: Test statistics for the paired sample *t*-test formula

$$t = \frac{\bar{x}_{\text{diff}} - 0}{s_{\bar{x}}}$$

where

$$s_{\bar{x}} = \frac{s_{\text{diff}}}{\sqrt{n}}$$

where

$\bar{x}_{\text{diff}}$ = Sample mean of the differences
 n = Sample size (i.e., number of observations)
 s_{diff} = Sample standard deviation of the differences
 $s_{\bar{x}}$ = Estimated standard error of the mean ($s/\sqrt{n}$)

Source: (KentState University library, 2020)

df: The degree of freedom for the test $(N-1) = 351$, where N = total number of the participants.

Sig. (2-tailed): The p -value corresponding to the test statistic t with degree of freedom (df).

Since the p -value is 0.004, which is less than 0.005; this means that there is a statistically significant difference between human behavior before and after disaster occurrence. Also 'mean' values show difference between two groups.

H1.B There is a difference in human behaviors in terms of their emotional felling (Getting worried, feeling upset, being extremely angry) before and during disaster occurrence (Total number of participants in the survey was 352).

To test this hypothesis, Paired sample t -Test will be applied to prove the hypothesis as the data of the current study comply with those statistical tools.

The Paired Sample t Test is parametric test for comparing two means that are from the same individual, object, or related unites (KentState University library, 2020).

Table 3.67: Paired sample statistics results for human behavior groups before and during-352 data

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Human behavior-Before	2.6968	352	.80530	.04292
	Human behavior-During	2.6895	352	.89141	.04751
<i>M*= Mean (Sum of observed value divided by the number of observations).</i>					
<i>SD**= Standard Deviation (A measure of the spread of score a way from mean).</i>					

Table 3.67 shows that total numbers for two groups were 352; the score of mean and standard deviation for group "before disaster" was 2.696, 0.805 respectively, while the score of mean and standard deviation for the group "during disaster" was 2.689, 0.891 respectively.

Table 3.68: Paired sample correlations results for human behavior groups before and during-352 data

Paired Samples Correlations					
			N	Correlation	Sig.
Pair 1	Human behavior-Before & Human behavior-During		352	.721	.000

Table 3.68 shows the paired sample correlation results between the two groups were ($r = 0.721$).

Table 3.69: Paired sample test results for human behavior groups before and during-352 data

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	HB Before – HB During	.00731	.63929	.03407	-.05971	.07432	.214	351	.830

Table 3.69 shows the paired samples *t*-test results reading from the left to the right:

Means = Give the average difference between two means variables (2.6968-2.6895=0.00731).

Std.Deviation =
$$\sigma = \sqrt{\frac{1}{N} \sum_{i=1}^N (x_i - \mu)^2}$$

Give the standard deviation of the difference scores = 0.63929

Standard error mean is the standard error (standard deviation divided by the square root of the sample size) = 0.03407

t: The test statistic (denoted *t*) for the paired T test = 0.214

df: The degree of freedom for the test (N-1) = 351, where N= total number of the participants.

Sig. (2-tailed): The *p*-value corresponding to the test statistic *t* with degree of freedom df.

Since the *p*-value is 0.830, which is more than 0.005; this means there is no a statistically significant difference between human behavior for the two groups before and during disaster occurrence. Moreover, the ‘mean’ values of the compered groups are so close to each other.

H2. There is a correlation between human behaviors before, during and after a disaster occurs.

To test this hypothesis the correlation analysis will be applied.

Table 3.70: Descriptive Statistics results between the human behaviors before, during and after a disaster occur

Descriptive Statistics			
Group Name	Number of participants	Mean	Standard Deviation (SD)
Human Behavior Before Disaster	352	2.6968	.80530
Human Behavior During Disaster	352	2.6895	.89141
Human Behavior After Disaster	352	2.5921	.92512

Table 3.70 shows that total numbers for three groups were 352; mean and SD scores for "before disaster" were 2.69, 0.80 respectively, mean and SD scores for "during

disaster" score were 2.68, 0.89 respectively, and mean and SD scores for "after disaster" were 2.59,0.92 respectively.

Table 3.71: Correlations results between human behaviors before, during and after a disaster occur

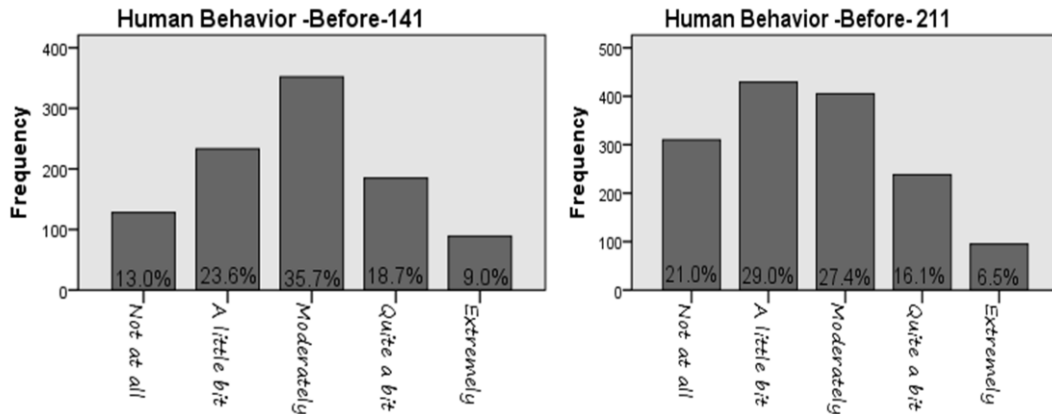
Correlations				
		Before Disaster	During Disaster	After Disaster
Before Disaster	Pearson Correlation (r)	1	,721**	,697**
	Significance (2-tailed)		,000	,000
	N	352	352	352
During Disaster	Pearson Correlation (r)	,721**	1	,798**
	Significance (2-tailed)	,000		,000
	N	352	352	352
After Disaster	Pearson Correlation (r)	,697**	,798**	1
	Significance (2-tailed)	,000	,000	
	N	352	352	352

****p<0.01. Significance = p value. r: Pearson correlation coefficients. N: Number of responders**

There is a significant correlation between the human behaviors before, during and after a disaster occurrence; this proves true by the Pearson correlation test that has been done to the data of the responders before, during and after disaster in the survey which was conducted between May and November 2019. Since the values of Pearson correlation lie between ± 0.50 and ± 1 , this means that there is a strong correlation between the response of the three groups.

H3.A There is a difference in human behaviors that can be observed as expressed by the participants in terms of their emotional felling (Getting worried, feeling upset, being extremely angry). Before part questions (Number of participants were 141) and before part questions (Number of participants were 211).

Figure 3.11: Bar histogram showing frequency results of human behaviour; data before-disaster of 141 participants and of the rest 211 participants, also before disaster



In figure 3.11 the results of the seven questions of each group are combined together depended on which option was chosen by the participants. To get these percentages, it is obvious that there is a variation in proportions between two groups in the human behavior questionnaire about participant's feelings and reactions in case a disaster occur. Moreover, to test this hypothesis Independent Sample *t*-Test is used to compare between two groups (pre-earthquake 141 and post-earthquake 211 scores).

Table 3.72: Statistics results for human behavior group's before (141-data) and before (211-data)

Group Statistics					
	Groups Name	N*	Mean	Std. Deviation	Std. Error Mean
Before-all	Group-before-141	141	2.8723	.75837	.06387
	Group-before-211	211	2.5796	.81610	.05618

*N = Number of participants.

Table 3.72 shows descriptive statistics for the two groups: First one (Before-141 total answers before earthquake) and second group (Before-211 total answers after earthquake). For the mean and standard deviation for two groups before-141 disaster score were (2.87, 0.75) respectively, while the mean and standard deviation for before-211 disaster score were (2.57, 0.81) respectively.

Table 3.73: Independent sample test for two groups (before-141 and before 211)

Independent Samples Test										
		Levene's Test for Equality of Variances		<i>t</i> -test for Equality of Means						
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Before-all	Equal variances assumed	3.242	.073	3.392	350	.001	.29279	.08631	.12303	.46254
	Equal variances not assumed			3.442	314.827	.001	.29279	.08506	.12543	.46015

The independent sample *t*-test table includes two rows:

Equal variances assumed and **Equal variances not assumed** by looking at Levene's results test p-value is 0.073, which is more than 0.005 that's mean the variances are equal across the two group that's will lead to rely on first row of outputs.

Table 3.73 shows independent samples test results reading from the left to the right:

First two columns give the results of Levene's test for equality of variances F and sig

F is the test statistic of Levene's test = 3.242

Sig is the *P*-value of Levene's test = 0.073

Other columns give the results of *t*-test for equality of means

t = 3.392 it had been computed as following:

Figure 3.12: Test statistic computed formula for the Equal variances assumed

$$t = \frac{\bar{x}_1 - \bar{x}_2}{s_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

with

$$s_p = \sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}}$$

Where

- $\bar{x}_1$ = Mean of first sample
- $\bar{x}_2$ = Mean of second sample
- n_1 = Sample size (i.e., number of observations) of first sample
- n_2 = Sample size (i.e., number of observations) of second sample
- s_1 = Standard deviation of first sample
- s_2 = Standard deviation of second sample
- s_p = Pooled standard deviation

Source: (KentState University library, 2020)

df is the degree of freedom $(n_1 + n_2 - 2) = 350$, where N = total number of the participants.

Sig (2-tailed) is the p-value to the given test = 0.001

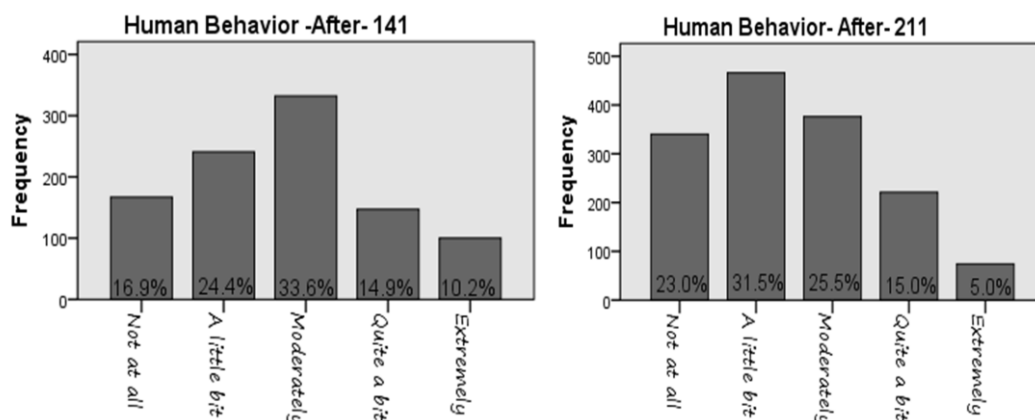
Mean Difference is the difference between sample means = 0.29279, and it is also corresponds to the numerator of the test statistic.

Std. Error Difference is the standard error = 0.08631 and it is also corresponds to the denominator of the test statistic.

To sum up, since the sig (p-value) = 0.001 which is less than 0.005, which means that there is a statistically significant difference between human behavior for the two groups.

H3.B There is a difference in human behaviors that can be observed as expressed by the participants in terms of their emotional felling (Getting worried, feeling upset, being extremely angry). After part questions (Number of participants were 141), and after part questions (Number of participants were 211).

Figure 3.13: Bar histogram of the frequency results of human behaviour after disaster; data for the two groups, the 141 and the 211 participants



In figure 3.13 the results of the seven questions of each group are combined together depended on which option was chosen by the participants. To get these percentages, it is obvious that there is a variation in proportions between two groups in the human behavior questionnaire about participant's feelings and reactions in case a disaster occur. Moreover, to test this hypothesis Independent Sample *t*-Test is used to compare between two groups (pre-earthquake 141 and post-earthquake 211 scores).

Table 3.74: Statistics results for human behavior group's after (141-data) and after (211-data)

Group Statistics					
	Groups	N*	Mean	Std. Deviation	Std. Error Mean
After-all	Group-after-141	141	2.7690	.90410	.07614
	Group-after-211	211	2.4739	.92223	.06349
*N = Number of participants.					

Table 3.74 shows descriptive statistics for the two groups: First one (After-141 total answers before earthquake) and second group (After-211 total answers after earthquake). For the mean and standard deviation for two groups after-141 disaster score were (2.76, 0.90) respectively, while the mean and standard deviation for after-211 disaster score were (2.47, 0.92) respectively.

Table 3.75: Independent sample test for two groups (after-141 and after-211)

Independent Samples Test									
	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper

After-all	Equal variances assumed	1.150	.284	2.965	350	.003	.29506	.09953	.09931	.49081
	Equal variances not assumed			2.976	304.296	.003	.29506	.09914	.09998	.49014

The independent sample *t*-test table includes two rows:

Equal variances assumed and **Equal variances not assumed** by looking at Levene's results test *p*-value is 0.284, which is more than 0.005 that's mean the variances are equal across the two group that's will lead to rely on first row of outputs.

Table 3.75 shows independent samples test results reading from the left to the right:

First two columns give the results of Levene's test for equality of variances *F* and *sig*
F is the test statistic of Levene's test = 1.150

Sig is the *P*-value of Levene's test = 0.284

Other columns give the results of *t*-test for equality of means

t = 2.965, and it had been computed as (see figure no.4.9.5)

df is the degree of freedom (n_1+n_2-2)= 350, where *N*= total number of the participants.

Sig (2-tailed) is the *p*-value to the given test = 0.003

Mean Difference is the difference between sample means = 0.295, and it is also corresponds to the numerator of the test statistic.

Std. Error Difference is the standard error = 0.099 and it is also corresponds to the denominator of the test statistic.

To sum up, since the *sig (p-value)* is 0.003, which is less than 0.005; this means that there is a statistically significant difference between human behaviors for the two groups.

H4.Using of social media applications during disaster event could be different from country to another.

To prove this hypothesis Cross tabulation method will be used.

Table 3.76: Using of social network applications (results before a disaster happens)

Before Disaster * Country					
Cross tabulation					
Which mobile application do you prefer to use it first?		Country			Total
		Turkey	Iraq	Other Countries	
Before Disaster	Twitter	11	0	3	14
	Facebook	19	49	4	72
	Instagram	4	3	2	9
	Whatsapp	64	24	7	95
	Skype	6	4	2	12
	Viber	1	8	0	9
Total		105	88	18	211

Figure 3.14: Bar graphic of the frequency results for which mobile applications potentially will be used before disaster occurrence in Turkey, and Iraq

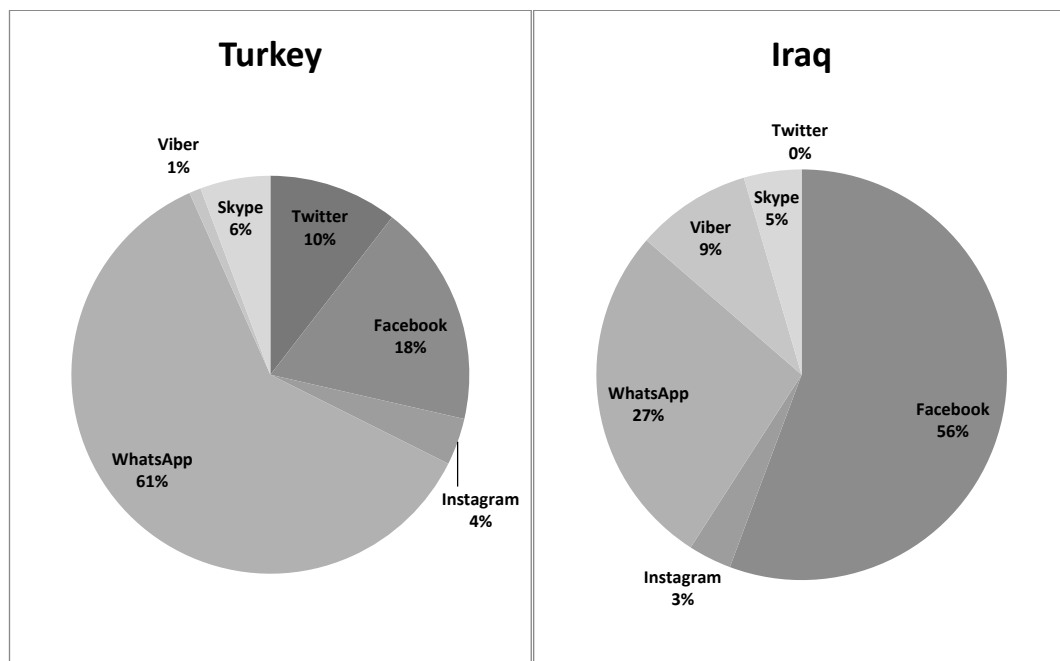


Table 3.76 and Figure 3.14 show in numbers and percentages participants responses for the question “Which mobile application prefer to use it first before disaster?” Total number of participants was 211 most of them were from Turkey (105), Iraq (88), and their answers were divided into:

1. Iraqi citizens choices; Facebook 49 (56 Percentage), Instagram 3 (3 Percentage), WhatsApp 24 (27 Percentage), Skype 4 (5 Percentage), and Viber 8 (9 Percentage).
2. Turkey citizens choices; Twitter 11 (10 Percentage), Facebook 19 (18 Percentage), Instagram 4 (4 Percentage), WhatsApp 64 (61 Percentage), Skype 6 (6 Percentage), and Viber 1 (1 Percentage).

Table 3.77: Using of social network applications (results during a disaster happens)

During Disaster * Country					
Cross tabulation					
Which mobile application do you prefer to use it first?		Country			Total
		Turkey	Iraq	Other Countries	
During Disaster	Twitter	6	0	2	8
	Facebook	24	58	5	87
	Instagram	1	0	0	1
	Whatsapp	71	25	9	105
	Viber	3	5	2	10
Total		105	88	18	211

Figure 3.15: Bar graphic of the frequency results for which mobile applications potentially will be used during disaster occurrence in Turkey, and Iraq

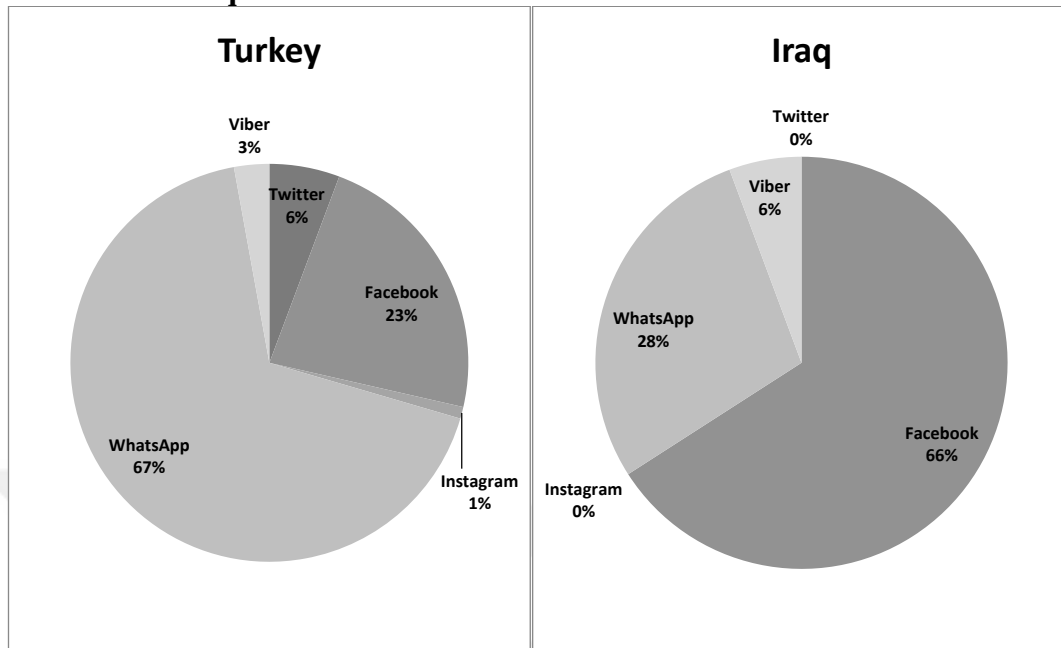


Table 3.77 and Figure 3.15 show in numbers and percentages participants responses for the question “Which mobile application prefer to use it first during disaster?” Total number of participants was 211 most of them were from Turkey (105), Iraq (88), and their answers were divided into:

1. Iraqi citizens choices; Facebook 58 (66 Percentage), WhatsApp 25 (28 Percentage), and Viber 5 (6 Percentage).
2. Turkey citizens choices; Twitter 6 (6 Percentage), Facebook 24 (23 Percentage), Instagram 1 (1 Percentage), WhatsApp 71 (68 Percentage), and Viber 3 (3 Percentage).

Table 3.78: Using of social network applications (results after a disaster happens)

After Disaster * Country					
Cross tabulation					
Which mobile application do you prefer to use it first?		Country			Total
		Turkey	Iraq	Other Countries	
After Disaster	Twitter	5	0	1	6

	Facebook	13	69	6	88
	Whatsapp	87	15	9	111
	Instagram	0	0	2	2
	Viber	0	4	0	4
Total		105	88	18	211

Figure 3.16: Bar graphic of the frequency results for which mobile applications potentially will be used during disaster occurrence in Turkey, and Iraq

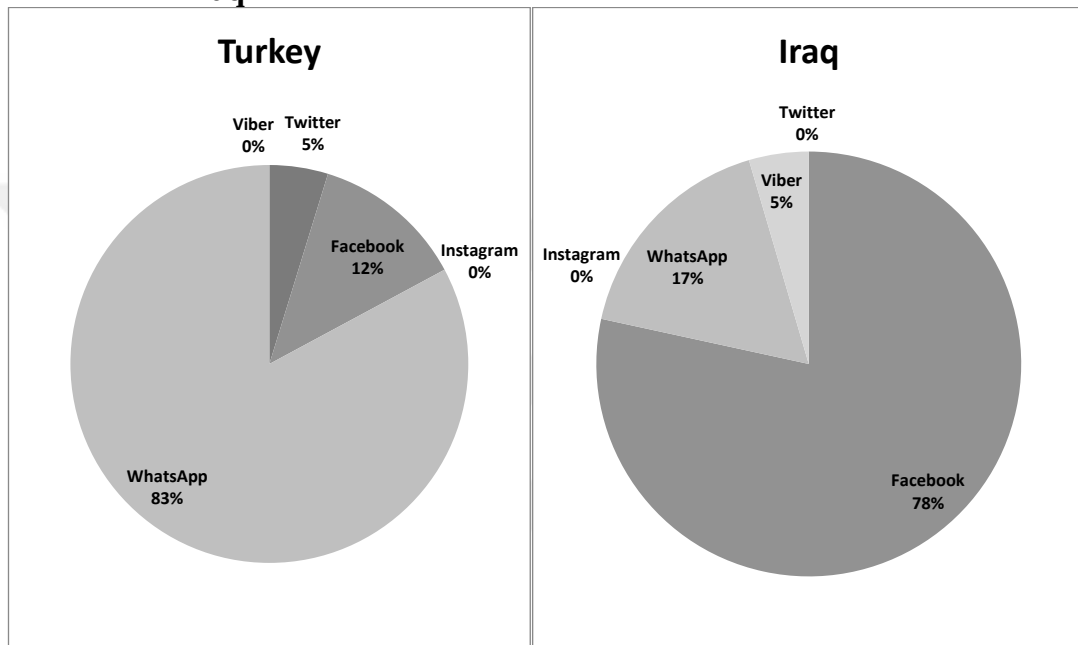


Table 3.78 and Figure 3.16 show in numbers and percentages participants responses for the question “Which mobile application prefer to use it first during disaster?” Total number of participants was 211 most of them were from Turkey (105), Iraq (88), and their answers were divided into:

1. Iraqi citizens choices; Facebook 69 (78 Percentage), WhatsApp 15 (17 Percentage), and Viber 4 (5 Percentage).
2. Turkey citizens choices; Twitter 5 (5 Percentage), Facebook 13 (12 Percentage), and WhatsApp 87 (83 Percentage).

To sum up, Based on the cross-tabulation and frequencies results:

1. Citizens of Iraq prefer to use Facebook application more than any applications to communicate with their relatives and friends before, during and after a disaster occurrence. According to the survey, out of 88 respondents from Iraq, between (49 and 69) numbers of respondents would use Facebook application to get all updates related to any incident in their surroundings. Less commonly, some participants believe that using other applications like WhatsApp, Viber during disaster helps them to be updated and allows them to contact their family and friends.

2. Citizens in Turkey prefer to use WhatsApp application more than any others applications to communicate with their relatives and friends before, during and after any disaster would occur. Around 105 participants from Turkey answered this question in all of the three phases of the disaster. Between (64 and 87) participants think that WhatsApp is an immediate and effective way of knowing the situation of their loved ones especially after a disaster has occurred. Another reason is that although in this advance technological era, one out of three people have an account on Facebook but still there is a vast majority of people who think that Facebook is just a waste of time. Beside, WhatsApp is a quick to go way of communication without any unexpected destruction.

H5. Citizens in general prefer to communicate with their relatives and friends using mobile call more than social media applications in all the stages of disaster.

Table 3.79: Citizens in general prefer to communicate with their relatives and friends using mobile call; data before disaster

Which option would you like to use to communicate with your relatives or friends frequently?		Responses	
		Number	Percentage
Answer options	Mobile call	275	78.1%
	SMS	101	28.6%
	Personal message on social media	258	73.2%
	public post on social media	47	13.3%
	Other	3	0.8%
Total		684	194%
<i>Percentages and totals are based on respondents. Note1: a "note" has been added to the question, (You can choose more than one option). Note2: In this table, the percentages were counted as following: the number of the selected option divided by the total number of the participants multiplied by 100 ($N/Total \text{ of } N * 100$).</i>			

Table 3.79 shows participant's choices and frequencies results for the question "Which option would you like to use to contact with your relative or friends?" Their answers were divided between mobile call 275 (78.1 Percentage), SMS 101 (28.6 Percentage), personal message on social media 258 (73.2 Percentage), public post on social media 47 (13.3 Percentage), and other 3 (0.8 Percentage).

Table 3.80: Cross tabulation between country and communication options (data before disaster)

Cross tabulation					
Which option would you like to use to communicate with your relatives or friends frequently?		Country			Total
		Turkey	Iraq	Other Countries	
Answer options	Mobile call	86	70	16	172
	SMS	15	37	3	55
	Personal message on social media	84	59	15	158
	public post on social media	14	15	7	36
	Other	0	0	1	1
Total participants		199	181	42	422
<i>Percentages and totals are based on respondents. Note: a "note" has been added to the question, (You can choose more than one option).</i>					

Table 3.80 shows the geographical divisions of the responders are divided into three parts:

1. Participants from **Turkey** who choice **Mobile call** were 86, **SMS** 15, **Personal message on social media** 84 and **Public post on social media** 14.
2. Participants from **Iraq** who choice **Mobile call** were 70, **SMS** 37, **Personal message on social media** 59 and **Public post on social media** 15.
3. Participants from different Countries who choice **Mobile call** were 16, **SMS** 3, **Personal message on social media** 15, **Public post on social media** 7 and **other** 1.

Table 3.81: Citizens in general prefer to communicate with their relatives and friends using mobile call; data during disaster event

Which option would you like to use to communicate with your relatives or friends during a disaster?		Responses	
		N	Percent
Answer options	Mobile call	307	87.2%
	SMS	131	37.2%
	Personal message on social media	210	59.6%
	public post on social media	70	19.8%
	Other	4	1.1%
Total		722	204.9%
Percentages and totals are based on respondents.			
Note1: a "note" has been added to the question, (You can choose more than one option).			
Note2: In this table, the percentages were counted as following: the number of the selected option divided by the total number of the participants multiplied by 100 ($N/Total\ of\ N * 100$).			

Table 3.81 shows participant's choices and frequencies results for the question "Which option would you like to use to contact with your relative or friends?" Their answers were divided between mobile call 307 (87.2 Percentage), SMS 131 (37.2 Percentage), personal message on social media 210 (59.6 Percentage), public post on social media 70 (19.8 Percentage), and other 4 (1.1 Percentage).

Table 3.82: Cross tabulation between country and communication options (Data during-disaster)

Cross tabulation					
Which option would you like to use to communicate with your relatives or friends during disaster?		Country			Total
		Turkey	Iraq	Other Countries	
Answer options	Mobile call	90	79	15	184
	SMS	42	42	4	88
	Personal message on social media	76	59	12	147
	public post on social media	17	20	6	43
	Other	1	1	1	3
Total participants		226	201	38	465
Percentages and totals are based on respondents.					
Note: a "note" has been added to the question, (You can choose more than one option).					

Table 3.82 shows the geographical divisions of the responders are divided into three parts:

1. Participants from **Turkey** who choice **Mobile call** were 90, **SMS** 42, **Personal message on social media** 76, **Public post on social media** 17 and **other** 1.
2. Participants from **Iraq** who choice **Mobile call** were 79, **SMS** 42, **Personal message on social media** 59, **Public post on social media** 20, and **other** 1.
3. Participants from different Countries who choice **Mobile call** were 15, **SMS** 4, **Personal message on social media** 12, **Public post on social media** 6 and **other** 1.

Table 3.83: Citizens in general prefer to communicate with their relatives and friends using mobile call; data after disaster event

Which option would you like to use to communicate with your relatives or friends after a disaster?		Responses	
		Number	Percent
Answer options	Mobile call	311	88.3%
	SMS	148	42%
	Personal message on social media	219	62.2%
	Public post on social media	70	19.8%
	Other	5	1.4%
Total		753	213.7%
Percentages and totals are based on respondents.			
Note1: a "note" has been added to the question, (You can choose more than one option).			
Note2: In this table, the percentages were counted as following: the number of the selected option divided by the total number of the participants multiplied by 100 ($N/\text{Total of } N * 100$).			

Table 3.83 shows participant's choices and frequencies results for the question "Which option would you like to use to contact with your relative or friends?" Their answers were divided between mobile call 311 (88.3 Percentage), SMS 148 (42 Percentage), personal message on social media 219 (62.2 Percentage), public post on social media 70 (19.8 Percentage), and other 5 (1.4 Percentage).

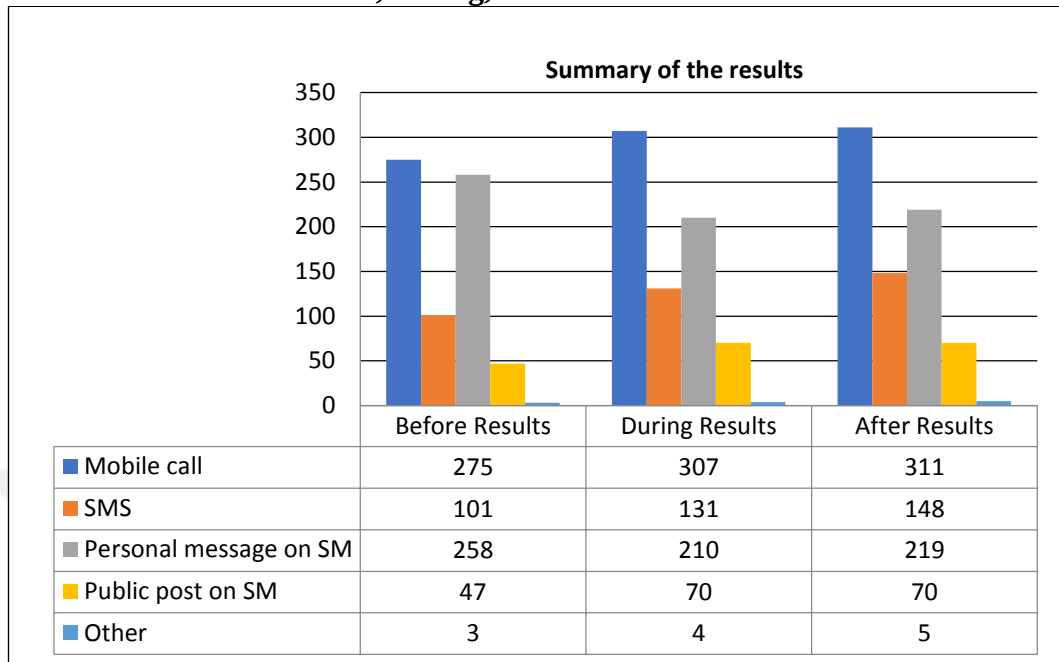
**Table 3.84: Cross tabulation between country and communication options
(Data after-disaster)**

Cross tabulation					
Which option would you like to use to communicate with your relatives or friends after disaster?		Country			Total
		Turkey	Iraq	Other Countries	
Answer options	Mobile call	96	82	14	192
	SMS	49	41	3	93
	Personal message on social media	70	65	15	150
	public post on social media	20	24	8	52
	Other	1	0	1	2
Total participants		236	212	41	489
Percentages and totals are based on respondents.					
Note: a "note" has been added to the question, (You can choose more than one option).					

Table 3.84 shows the geographical divisions of the responders are divided into three parts:

1. Participants from **Turkey** who choice **Mobile call** were 96, **SMS** 49, **Personal message on social media** 70, **Public post on social media** 20 and **other** 1.
2. Participants from **Iraq** who choice **Mobile call** were 82, **SMS** 41, **Personal message on social media** 65 and **Public post on social media** 24.
3. Participants from different Countries who choice **Mobile call** were 14, **SMS** 3, **Personal message on social media** 15, **Public post on social media** 8 and **other** 1.

Figure 3.17: Bar histogram summary of the results regarding which options people prefer to use it to communicate with their relatives and friends before, during, after disaster



SM: Social Media

Figure 3.17 illustrates summary results of respondents for the repeated question “Which option would you like to use to communicate with your relatives or friends?”, moreover this question was repeated in the three forms of social media questions (before, during, after). Obviously, the largest proportion of the participants chose mobile call over other options.

Based on Frequencies and Cross-tabulation results, participants, in general, prefer to communicate with their relatives and friends using mobile calls more than any other social media application. The current study results shows that a higher percentages of people would be communicating via the mobile calls during all three phases of a disaster, i.e. before, during, and after its occurrence; figures were between 78 Percentage and 88 Percentage. This means that the peoples' priority is to use mobile call for contacting their family members. However, in case there is communication problem, or mobile services are interfered with for one reason or another, during a disaster, 62 Percentage to 73 Percentage of people will use the ”Messages” on social media. Furthermore, the study has shown that a person who has a large number of family and friends in his or her social media list, then writing about the situation on

social media helps him or her to contact that large number of people. Thus, the latest way of communication is the most convenient way to ensure communication rather than sending messages to everyone on messenger and replying them, a way that may waste a lot of time in a critical situation.

H6. There is a relation between spending time on social media sites and gender type.

To test this hypothesis the correlation analysis will be applied.

Table 3.85: Correlation between times spent on social media sites and gender type

Correlations			
		How many hours per day do you spend time on social media sites?	Gender
Time spend on SM	Pearson Correlation	1	,042
	Sig. (2-tailed)		,433
	N	352	352
Gender	Pearson Correlation	,042	1
	Sig. (2-tailed)	,433	
	N	352	352

According to the correlations test which runs to find if there is any relation between the gender kind and the efficient time spends on social media sites. Surprisingly, the results show no correlation, due to the values of Pearson correlation were less than ± 0.50 , creating a weak correlation. That's means spending time on social media sites cannot be affected by the gender kind.

H7. There is a relation between age and time spending on social media per day.

To test this hypothesis the correlation analysis and Cross tabulation method will be applied.

Table 3.86: Relationship between time duration spending on social media sites and age range (1)

Correlations			
		How many Hours per day do you spend on social network sites?	Age
How many Hours per day do you spend on social network sites?	Pearson Correlation	1	-.186**
	Sig = p value		.000
	N	352	352
Age	Pearson Correlation	-.186**	1
	Sig = p value	.000	
	N	352	352
**: Correlation is significant at the 0.01 level (2-tailed).			

According to correlation analysis results, there is a negative correlation between age levels and time spending on social media sites per day at (-0.186**) and significance degree = $0.000 < p$.

Table 3.87: Relationship between time duration spending on social media sites and age range (2)

		Age * How many hours per day do you spend on social network sites?					
		Cross tabulation					
Age range		How many hours per day do you spend on social network sites?					Total
		0-1	2-3	4-5	More than 6 hours	It depends on the need	
17-30	Count	18	93	48	22	35	216
	Percentages	8.3%	43.1%	22.2%	10.2%	16.2%	61.4%
31- 46 & above	Count	34	59	20	7	16	136
	Percentages	25%	43.4%	14.7%	5.1%	11.8%	38.6%
Total	Count	52	152	68	29	51	352

	Percentages	14.8%	43.2%	19.3%	8.2%	14.5%	100%
Note: In this table, the percentages were counted as following: the number of the selected option divided by the total number of the participants multiplied by 100 ($N/\text{Total of } N * 100$).							

Firstly, in the table 3.86 the results show that there is a significant correlation between time spending on social media and the age group by applying Pearson Correlation Test. Although, the value is less than ± 0.50 which was $(-.186^{**})$ but it has negative correlation. In the other words as one of the variable increases, the other tends to decrease and vice versa. That's means there is a negative relation between age and time spending on social media sites.

Secondly, in the table 3.87 by applying Cross-tabulation method, and looking at the answered questions under columns (4-5 hours, and more than 6 hours) the results show that the total participants for the first age group 17 to 30 years were 48 (22.2 Percentage) for the 4-5 hours option, and were 22 (10.2 Percentage) for the option more than 6 hours.

While for the second age group 31 to 45 years and above where 20 (14.7 Percentage) for the 4-5 hours option, and 5 (5.1 Percentage) for the option more than 6 hours.

Thus, these results prove that there is a reversed relation between age and duration of time spent on social media sites per day.

In other words, whenever a person gets older in age, he or she is becoming less time-spent social media sites user and vice versa.

To sum up, obviously that younger generation is more likely to spend time on social media sites than middle age group generation.

H8. There is correlation between time spending on social media sites and the education level.

To test this hypothesis the correlation analysis will be applied.

Table 3.88: Relationship between time spending on social media sites and education levels

		Education Level	How many hours per day do you spend on social network sites?
Education Level	Pearson Correlation	1	0.060
	Significance = p value		.263
	N	352	352
How many hours per day do you spend on social network sites?	Pearson Correlation	0.060	1
	Significance = p value	0.263	
	N	352	352

Based on the results of table 3.88 there is no relationship between duration of time spent on social media sites and the education level. According to the survey, the result of Pearson Correlation Test shows that the value is (0.060) which is less than ± 0.50 , although it is positive value, so far it has almost a very small correlation. To explain that, whether a person is more or less educated, it will not have any obvious effect on how many hours will he/she spends on social media for many different purposes.

H9. There is a relation between using IoT technology and age levels. (Young generations are more likely to use IoT technology than middle age generations).

To test this hypothesis the Person correlation test, and Cross tabulation method will be applied.

Table 3.89: Correlation results between usages of IoT technology in the future and age levels

Correlations Results			
		Age levels	Are you going to use IoT technology to control your home equipment?
Age levels	Pearson Correlation	1	-.150**
	Sig = p value		.004
	N	352	352
IoT technology	Pearson Correlation	-.150**	1
	Sig = p value	.004	
	N	352	352

**. Correlation is significant at the 0.01 level (2-tailed).

According to correlation analysis results, there is a negative correlation between age levels and IoT technology usage at (-0.150**) and significance degree = $0.004 < p$.

Table 3.90: Cross tabulation and frequency results between usage of IoT technology in the future and age levels

Age * IoT Technology Cross tabulation					
Age range		Are you going to use IoT technology to control your home equipment?			Total
		No	May be in the future	I used it already	
17-30	Count	26	143	47	216
	Percentages	12%	66%	21.8%	61.4%
31- 46 & above	Count	23	100	13	136
	Percentages	16.9%	73.5%	9.5%	38.6%
Total	Count	49	243	60	352
	Percentages	13.9%	69%	17.1%	100%

Note: In this table, the percentages were counted as following: the number of the selected option divided by the total number of the participants multiplied by 100 ($N/\text{Total of } N * 100$).

Firstly, in the table 3.89 the results show that there is a significant correlation between IoT uses technology and the age group by applying Pearson Correlation Test. Although, the value is less than ± 0.50 which was (-.150**) but it has negative correlation. In the other words as one of the variable increases, the other tends to decrease and vice versa. That's means there is a negative relation between age and uses of IoT technology.

Secondly, according to the cross tabulation table 3.90, it is obvious that the young generations tend to use IoT technology more than the middle age generations.

By looking at the values under the option (I used it already): 21.8 Percentage of the age group (17-30) years admit using IoT technology in their home compared with 9.5 Percentage of the other age group (31-46 and above) years.

3.10 APPROVED RESULTS OF HYPOTHESIS

Table 3.91: Approved Results of Hypothesis

The summary of hypothesis analysis is presented in this table:

Hypothesis Number	Hypothesis	Conclusion	Proven (✓) or Not Proven (X)
H1.A.	There is a difference between human behavior before and after disaster. (All Responses-352).	The significant results of Paired Sample <i>t</i> -Test (sig= 0.004) was less than $p= 0.005$ that's proved a statistical significant difference between the two groups.	(✓)
H1.B.	There is a difference between human behavior before and during disaster. (All Responses-352).	The result of Paired Sample <i>t</i> -Test was significant at $0.830 > p\text{-value} = 0.005$ that's leads to rejection of the hypothesis.	(X)
H2.	There is a correlation between human behaviors before, during and after a disaster occurs.	The values of Pearson correlation lie between ± 0.50 and ± 1 , creating a strong correlation.	(✓)
H3.A.	There is a difference between HB 1 ST group (HBB-141) before the earthquake and the HB 2 nd group (HBB-211) after earthquake that stroked Istanbul on 26th of September 2019.	The results of Independent Sample <i>t</i> -Test was significant $0.001 < p= 0.005$ that's proved a significant difference between the two groups.	(✓)
H3.B.	There is a difference between HB 1 ST copy (HBA-141) before the earthquake and the HB 2 nd copy (HBA-211) after earthquake that stroked Istanbul on 26th of September 2019.	The results of Independent Sample <i>t</i> -Test was significant $0.003 < p= 0.005$ that's proved a significant difference between the two groups.	(✓)

Table 3.91: Approved Results of Hypothesis – continued

H4	Using of social media applications during disaster event could be different from country to another.	According to the survey, out of 88 participants from Iraq, choose Facebook application as their first option that can be used to get updates that related to any incident around their surroundings. Their number was 49 before, 58 during, and 69 after disaster, While around 105 participants from Turkey mention that WhatsApp is an immediate and effective way of knowing the situation of their beloved ones. Their number was 64 before, 71 during, and 87 after disaster.	(√)
H5	People in general prefer to be in contact with their relatives and friends using mobile calls more than social media applications.	The survey suggests that among 352 participants, priority is to use mobile call for contacting their family members in the all stages of disaster. Their number was 275 before, 307 during, and 311 after disaster.	(√)
H6	There is relation between gender type and time spending on social media sites.	Men and Women use social media network services differently. Survey results approve that there is no variation between time spending on social media and gender.	(X)
H7	The young generation is more attached to social media and its use whether they are aware or unaware by its pros or cons.	The total responders are 352 with almost more than half of the respondents (216) was in the age group range of 17-30 year. Thus, concludes that they are more bound to the use of social media.	(√)

Table 3.91: Approved Results of Hypothesis – continued

H8	There is relation between time spending on social media and the education levels.	The value result of Pearson correlation is less than 0.5 which does not create a strong correlation.	(X)
H9	There is a relation between usages of IoT technology and age levels.	The assumption that young generations are more likely to use IoT technology than middle age generations has been proved by applying Person correlation analysis & Cross Tabulation.	(√)
<i>*HBB: Human Behavior Before disaster group results.</i> <i>*HBA: Human behavior After disaster group results.</i> <i>*IoT: Internet of Things.</i>			

4. DISCUSSION

Disasters whether "natural" or "man-made", have substantial impact, or even detrimental effect, on communities and civilizations; those disaster-imposed risks are in terms of human behaviour aspect and material resources; the latter may include residential and governmental buildings, roads, industrial premises, agricultural farms, forests, electrical power towers, telecommunication installations, and others incorporated in the ecosystem of all aspects of life. A disaster represents a serious disruption of the functioning of a community or a society involving widespread loss of human, material, and economic resources; the latter loss may exceed the ability of the affected community or society to cope using its own resources. When discussing disaster management, there are a few processes that form the links in the chain and work in tandem to complete the emergency management lifecycle. The process starts with the identification of risks, setting up early warning signaling systems, resources allocation, disaster preparedness, emergency response, reaction planning, and lastly effective and fruitful disaster recovery.

Fortunately, communications, including mobile phones, web-based services, IoT and online social media may provide an outstanding help, and solutions, for disaster management. IoT has the solution to help the disaster management agencies at every stage of the process. Ideally such modalities and means of communications should be integrated between governments and communities citizens, whether they are people actively involved in one way or another in the management of disasters or ordinary community members. The establishment and set up of such competent integrated systems of communication, with other essential appropriate measures, are mandatory for the purposes of early warning, rescue services, and recovery from the disaster.

Exploring how people may use and feel about using the modality of communication, IoT, and social media, and their "human" behaviour before, during, and after a disaster, a format of "Questionnaires" was distributed through the internet to people from different countries, between June 2019 - November 2019. 352 persons, from both sexes responded, ages ranged from 17- years to above 45, from different

educational levels, inhabiting Turkey, Iraq, and other countries. The results have been converted to tables and figures (see results).

4.1 HUMAN BEHAVIOUR DISCUSSION

Considerations of adverse psychological and behavioral effects often focus on psychological disorders, such as post-traumatic stress disorder, depression, and anxiety. These disorders do occur following disasters and result in considerable morbidity and mortality, warranting prompt assessment and evidence-based interventions. In addition to disorders, earlier and more common responses include distress reactions and health risk behaviors (Ursano RJ, 2017).

Looking up on tables 4.1, 2, 3, and 4 which include and summarize the findings of human behaviour of the participants in the current study, we may comment that majority of the participants had experienced some sort of behavioural changes before, during, and after the event of disaster that they had met and suffered. However, when we take the average of those participants as mentioned in table 4.4, their number ranges from 242.7 (68.9 Percentage) – 306 (86.9 Percentage). These findings are in keeping with the findings of other researchers mentioned above (North CS, 2013), (Palinkas LA, 1993), (Osofsky HJ, 2017), (Lai BS, 2020), and (Ursano RJ, 2017). However, the disaster sufferers in the current study were more than the third of disaster sufferers found by (North CS, 2013) and almost equal to the number of those in the study of (Osofsky HJ, 2017), namely 81.1 Percentage in the current study and 76 Percentage in the (Osofsky HJ, 2017) study respectively (Table 4.1).

In healthcare settings, concerns such as insomnia, anxiety, and altered substance use patterns are most commonly identified in primary care and emergency settings. It is important for healthcare systems to ensure adequate education and resourcing of primary care and emergency personnel to manage the predictable responses following ecological disasters. Understanding the broad range of adverse effects will enhance planning and preparedness, as well as response and recovery efforts, by disaster managers, healthcare personnel, and community members. It is important that education and training for healthcare personnel and disaster managers continue to

evolve beyond contemporary approaches of diagnosing and treating illness. Instead, there should be a transition to early screening and delivery of public health interventions that are evidence-based, cost-effective, readily accessible, and community-focused with the goal of reducing distress, enhancing well-being and functioning, reducing the rate of progression to psychological disorders and, ultimately, improving the overall trajectory of community recovery following disasters (Joshua C. Morganstein., 2020).

Therefore, taking into account the varied profile of human behaviour during and after the events of disasters, it is quite essential and mandatory that health care personnel should have, in advance, well elaborated and documented solutions and treatment strategies, and resources, to deal with the wide spectrum of psychological and / or behavioural changes disasters' sufferers may show.

Table 4.1: Summary of human behaviour profile as reported by participants of the current study; before disaster

Questionnaire {Kind/profile of human behaviour (psychological) upset}	Number and percentage of participants and their response before disaster (total 352)	
	Not at All (%)	Yes to suffering (Answers include little bit, moderate, quite a bit, extreme,.) (%)
Will you get worried as you hear a stressful event is happening soon?	33 (9.4%)	319 (90.6%)
Do you feel very emotionally upset when something reminded you of the stressful event?	45 (12.8%)	307 (87.2%)
Do you feel like you are detached or distant from yourself, your body, your physical surroundings or your memories?	83 (23.6%)	269 (76.4%)
Do you try to avoid thoughts, feelings, or physical sensations that reminded you of the stressful event?	42 (11.9%)	310 (88.1%)
Being "super alert," on guard, or constantly on the lookout for danger?	54 (15.3%)	298 (84.7%)
Do you feel jumpy or easily startled when you hear an unexpected noise?	67 (19.0%)	285 (81%)

Do you get extremely irritable or angry at any point where you scream on other people, get into fights, or destroyed things?	114 (32.4%)	238 (67.6%)
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Table 4.2: Summary of human behaviour profile as reported by participants of the current study, during disaster

Questionnaire {Kind/profile of human behaviour (psychological) upset}	Number and percentage of participants and their response during disaster (total 352)	
	Not at All (%)	Yes to suffering (Answers include little bit, moderate, quite a bit, extreme,.) (%)
Are your worries about the event reaching the degree of panic attack?	106 (30.1%)	246 (69.1%)
Feeling very emotionally upset when you are experiencing the traumatic event?	48 (13.6%)	304 (86.4%)
Feeling detached or distant from yourself, your body, your physical surroundings, or your memories?	72 (20.5%)	280 (79.5%)
Trying to avoid thoughts, feelings, or physical sensations that you're experiencing during the stressful event?	46 (13.1%)	306 (86.9%)
Being "super alert," on guard, or constantly on the lookout for danger?	39 (11.1%)	313 (88.9%)
Feeling jumpy or easily startled when you hear an unexpected noise?	51 (14.5%)	301 (85.5%)
Being extremely irritable or angry to the point where you yelled at other people, got into fights, or destroyed things?	100 (28.4%)	252 (71.6%)

Table 4.3: Summary of human behaviour profile as reported by participants of the current study; after disaster

Questionnaire {Kind/profile of human behaviour (psychological) upset}	Number and percentage of participants and their response after disaster (total 352)	
	Not at All (%)	Yes to suffering (Answers include little bit, moderate, quite a bit, extreme,...) (%)
Having “flashbacks,” that is, you suddenly acted or felt as if a stressful experience from the past was happening all over again (for example, you re-experienced parts of a stressful experience by seeing, hearing, smelling, or physically feeling parts of the experience)?	64 (18.2%)	288 (81.8%)
Feeling very emotionally upset when something reminded you of a stressful experience?	50 (14.2%)	302 (85.8%)
Feeling detached or distant from yourself, your body, your physical surroundings or your memories?	86 (24.4%)	266 (75.6%)
Trying to avoid thoughts, feelings, or physical sensations that reminded you of a stressful experience?	50 (14.2%)	302 (85.8%)
Being "super alert," on guard, or constantly on the lookout for danger?	62 (17.6%)	290 (82.4%%)
Do you feel jumpy or easily startled when you hear an unexpected noise?	77 (21.9%)	275 (78.1%)
Being extremely irritable or angry to the point where you scream (yelled) at other people, got into fights, or destroyed things?	114 (32.4%)	238 (67.6%)

Table 4.4: Comparison of participants' behavioural suffering and experience profile (those who say "Yes") before, during, and after the disaster

Questionnaire {Kind/profile of human behaviour (psychological) upset}	Total number and percentage of participants who said "Yes" to behavioural changes			Average (%)
	Before disaster	During disaster	After disaster	
Having “flashbacks,” that is, you suddenly acted or felt as if a stressful experience from the past was happening all over again (for example, you re-experienced parts of a stressful experience by seeing, hearing, smelling, or physically feeling parts of the experience)?	–	–	288 (81.8%)	288 (81.8%)
Will you get worried as you hear a stressful event is happening soon?	319 (90.6%)	246 (69.1%)	–	282.5 (79.9%)
Feeling very emotionally upset when something reminded you of the stressful event?	307 (87.2%)	304 (86.4%)	302 (85.8%)	304.3 (86.5%)
Feeling like you are detached or distant from yourself, your body, your physical surroundings or your memories?	269 (76.4%)	280 (79.5%)	266 (75.6%)	271.7 (77.2%)
Trying to avoid thoughts, feelings, or physical sensations that reminded you of the stressful event?	310 (88.1%)	306 (86.9%)	302 (85.8%)	306 (86.9%)
Being "super alert,” on guard, or constantly on the lookout for danger?	298 (84.7%)	313 (88.9%)	290 (82.4%)	300.3 (85.3%)
Feeling jumpy or easily startled when you hear an unexpected noise?	285 (81%)	301 (85.5%)	275 (78.1%)	287 (81.5%)
Do you get extremely irritable or angry at any point where you scream on other people, get into fights, or destroyed things?	238 (67.6%)	252 (71.6%)	238 (67.6%)	242.7 (68.9%)
Total number of participants in the current study is 352. Average number of participants suffered behavioural changes throughout three phases of the disaster is around 285.3 (81.1%).				

4.2 SOCIAL MEDIA DISCUSSION

(Muniz-Rodriguez K et al., 2020) Researching social media during natural disasters have found that social media has been presented as a tool to guide response and relief efforts in the disciplines of geography and computer sciences. This systematic review highlights the public health implications of social media use in the response phase of the emergency, assessing (1) how social media can improve the dissemination of emergency warning and response information during and after a natural disaster, and (2) how social media can help identify physical, medical, functional, and emotional needs after a natural disaster (Muniz-Rodriguez K et al., 2020). Furthermore, (Muniz-Rodriguez K et al., 2020) in their literature survey of 44 researches and using 3 databases, had found that social media platforms were identified as broadcasting tools presenting an opportunity for public health agencies to share emergency warnings. Social media, they stated, was used as a tool to identify areas in need of relief operations or medical assistance by using self-reported location, with map development as a common method to visualize data. Moreover, they admitted that in retrospective analyses, social media analysis showed promise as an opportunity to reduce the time of response and to identify the individuals' location. However, they advised that further research for misinformation and rumor control using social media is needed (Muniz-Rodriguez K et al., 2020).

Table 4.5: The different between Iraq & Turkey about mobile applications most usage in the three stages of disaster

Applications	IRAQ			TURKEY		
	Before Disaster	During Disaster	After Disaster	Before Disaster	During Disaster	After Disaster
Twitter	0	0	0	11	6	5
Facebook	49	58	69	19	24	13
Instagram	3	0	0	4	1	0
WhatsApp	24	25	15	64	71	87
Skype	4	0	0	6	0	0
Viber	8	5	4	1	3	0
Total	88	88	88	105	105	105

The results of table 4.5 show that there are a greater number of users of Facebook in Iraq as compare to Turkey and citizens of Turkey prefer WhatsApp to communicate with their friends and families before, during, and after disaster. Facebook can be used as a platform for preparing the citizens of Iraq before any disaster. Alert warnings can be generated through Facebook posts before or during the disaster. Facebook has the feature of getting the details from their users that ask the user of 'Feeling Safe' during the disaster. This will help the government organizations to gather the data of the affected areas and planning can be done to assist the victims. Beside this, in future the pre-disaster plan can be frame out for the citizens of Iraq. Citizens of Turkey think that WhatsApp is a quick-to-go way of communication with their families and friends. WhatsApp can provide a feature in their application in which the user can have the option of marking their family members contact as the important one. Whenever any of the users get affected by the disaster, their important contacts will be notified on just one click.

Table 4.6: Communication ways results for three stages of disaster

Options	Before Disaster		During Disaster		After Disaster	
	Number	Percentage	Number	Percentage	Number	Percentage
Mobile Call	275	78.1%	307	87.2%	311	88.3%
SMS	101	28.6%	131	37.2%	148	42%
Personal message on social media	258	73.2%	210	59.6%	219	62.2%
Public post on social media	47	13.3%	70	19.8%	70	19.8%
Other	3	0.8%	4	1.1%	5	1.4%
Total	684	194%	722	204.9%	753	213.7%
<i>Note: Question with note you can choice more than one option.</i>						

The results of table 4.6 shows most of the participants choice Mobile call as their first way to communicate with their family and friends before, during, after disaster. This means that the people's priority is to use mobile call for contacting their family members. However, in case there is communication problem, or mobile service are

disable with for one reason or another, 62 Percentage to 73 Percentage of people will switch to social media application to contact with their family members and friends. These results are in keeping with Craig Fugate (Administrator of the Federal Emergency Management Agency (FEMA)) speech in 2011 to the Us Senate's Committee on Homeland Security and Government Affairs his message was social media can provides the tools needed to minimize the communication gap between first responders and the public, and to participate in an active, ongoing dialogue. Fugate stressed that the public, should be able to easily communicate with emergency managers to act as the "first responders" (Lieberman, 2011).

Table 4.7: Social media applications results for three stages of disaster

Options	Before Disaster		During Disaster		After Disaster	
	Number	Percentage	Number	Percentage	Number	Percentage
Twitter	82	23.2%	53	15%	65	18.4%
Facebook	156	44.3%	134	38%	145	41.1%
Instagram	207	58.8%	137	38.9%	153	43.4%
WhatsApp	301	85.5%	302	85.7%	291	82.6%
Snapchat	70	19.8%	46	13%	42	11.9%
Skype	32	9%	10	2.8%	13	3.6%
Viber	65	18.4%	52	14.7%	58	16.4%
Other	33	9.3%	24	6.8%	25	7.1%
Total	946	268.3%	758	214.9%	792	224.5%
<i>Note: Question with note you can choice more than one option.</i>						

By looking up on table 4.7 which include answered for a question repeated three times asked in the survey (Social media part before, during and after) the results show that most of the responses choice WhatsApp application as their first choice to communicate with their family members and friends, followed by Instagram in the second position and Facebook in the third position. These results are not match with (Chavez, 2010) surveyed; several said Twitter was best suited for their purpose. That conflict in opinion lead to disaster management organization should do regular

researches to know which social media applications are common in use because technology grows and change rapidly.

Table 4.8: Communication channels results for stage before disaster

Options	Number	Percentage
Social Media	291	82.6%
TV	152	43.1%
Radio	51	14.4%
SMS Moblie	66	18.7%
Siren	17	4.8%
Newspaper	27	7.6%
Websites	77	21.8%
Other	3	0.8%
Total	684	193.8%
<i>Note: Question with note you can choice more than one option.</i>		

Table 4.8 results show that 82.6 percentage of the responses choice social media as a communication channel prefer to receive warning notification on it before disaster occur more than any other options. This result match with a survey published by an American Red Cross about social media usage and carried out in 2010 indicate that 24 percentage of the US population and 31 percentage of the online population would use the media to tell family and friends they are save (Blanchard, 2010).

Table 4.9: Result of a question: Do you think that you will receive any disaster warning on social media? (Before disaster part)

Options	Number	Percentage
No	45	12.8%
Maybe	145	41.2%
Yes	162	46%
Total	352	100%

Table 4.8 and 4.9 shows that between 45 percentage - 57 percentage of the participants think that they will receive warning messages on social media before and during disaster occur. These results match with previous questioner in a survey done by (Barr P., 2011) about Integration of social media into emergency planning and crisis management the results found that 80 Percentage of US general public and 69 percentage of online users felt that it would be beneficial for national emergency response organization to monitor social networking sites regularly (David Alexander, 2013).

Table 4.10: Results of questions about possible reaction from responses (During disaster part)

Questions	Will you send or receive request for help or assistance on social media?			Total	Will you try to inform others about one's own condition and location and learn about a disaster-affected individual's condition and location by using social media?			Total
	No	Maybe	Yes		No	Maybe	Yes	
Options								
Number	36	156	160	352	19	132	201	352
Percentage	10.2%	44.3%	45.5%	100%	5.4%	37.5%	57.1%	100%

Table 4.11: Results of questions about possible reaction from responses (After disaster part)

Questions	Options			Total
	No	Maybe	Yes	
Will you try to help rescue teams by sending reports or videos or pictures on social media?	28	153	171	352
	8%	43.5%	48.6%	100%
Will you use Social media to spread information about affected or rescue places?	26	143	183	352
	7.4%	40.6%	52%	100%
Will you provide receiving information about disaster response, recovery, and mitigation; tell and hear stories about disaster on social media?	24	144	184	352
	6.8%	40.9%	52.3%	100%
Would you prefer to raise and develop awareness of an	24	151	177	352

event; donate and receive donations; identify and list ways to help or volunteer on social media?	6.8%	42.9%	50.3%	100%
Will you try to document or inform people or give advice or follow the news at that time on social media?	24	142	185	352
	6.8%	40.3%	52.8%	100%

People on the ground may be the source of both the first reports and the most detailed reports (including picture and video), and can make such information widely available to the public using social media. While government agencies are generally risk-averse, social media provides the opportunity to enhance public relations efforts and capabilities and can improve the public's trust of government response (National Research Council, 2013b) This requires advance planning, experimenting with various workflows and technologies to perfect the rapid dissemination of information.

4.3 INTERNET OF THINGS (IOT) DISCUSSION

Table 4.12 summarizes the responses of the current study participants regarding the IoT. Although 181 (51.4 percentage) of them have admitted their unawareness of the availability of an infrastructure to the IoT, however, 208 (59.1 percentage) participants mentioned that the internet is available continuously and efficiently in their country, which is a good thing to invest throughout the three phases of any disaster. Furthermore, 268 (76.1 percentage) do admit using the internet to know about the weather conditions.

However, it is necessary to mention that in the context of the health issue (safety of internet sensors on human beings), 94 (26.7 percentage) of the participants agreed on its negative aspect, 92 (22.1 percentage) disagree, while 166 (47.2 percentage) had no idea about their effect on peoples' health. Having said that 194 (55.1 percentage) admit that the IoT creates positive attitudes to reduce disaster consequences, 201 (57.1 percentage) think that IoT can increase productivity of social media, and that 243 (69 percentage) of the participants are going to use IoT in controlling equipment in their homes and premises, although 60 (17 percentage) were already using them.

Table 4.12: Summary of IoT as reported by participants of the current study

Questions	Answered options		
Is the internet service available efficiently continuously in your country?	No (40) 11.4%	Sometimes (104) 29.5%	Yes (208) 59.1%
Is infrastructure for IoT is available in your city?	No (63) 17.9%	I have no idea (181) 51.4%	Yes (108) 30.7%
Do you use internet network to learn about weather news and conditions?	No (10) 2.8%	Sometimes (74) 21%	Yes (268) 76.1%
Do you think IoT creates positive attitudes to reduce disaster consequences?	Disagree (14) 4%	I have no idea (144) 40.9%	Agree (194) 55.1%
Do you think IoT sensors can have negative effect on people health?	Disagree (92) 26.1%	I have no idea (166) 47.2%	Agree (94) 26.7%
Do you think IoT can increase productivity of social media?	Disagree (15) 4.3%	I have no idea (136) 38.6%	Agree (201) 57.1%
Are you going to use IoT technology to control your home equipment?	No (49) 13.9%	Maybe in the future (243) 69%	I used it already (60) 17%

By looking at the results 30.7 percentage were sure about availability of the IoT in their cities. These finding are in keeping with the survey done by (Metova, 2020) under title “Awareness of IoT” they establish this survey in their second annual revealing on 12 of June 2019 in their report they said that every year there is 25% increasing in number of consumers understanding what IoT “Internet of Things” is meaning. But still less than 1 in 4 fully understands the term (Metova, 2020).

Note about hypotheses and outcome of data

It is obvious to find that the aforementioned findings and their discussion confirm and support the hypotheses that had been presumed and mentioned earlier in this study (please see table 3.91, the hypotheses).



5. CONCLUSION AND RECOMMENDATIONS

To sum up, the circumstances that facilitate the way for the striking of any disaster once available, they cannot be avoided. On the other hand, what can be done to soothe is harmful terrific afterwards effects can be mitigated by the IoTs. It is a serious interconnecting system that can monitor the surrounding events provocation the happening of the disaster, warning and alleviate its seriousness with the help of the embedded sensors and arcades.

Besides, officious relief efforts for the whole society and ecosystem from the vicious effect of any kind of a disaster. Thus, its major feature is not only before but also during and after a natural disaster by connecting community and disseminating emergency information.

This connectivity will make the society safer, helping everyone what actions to be taken into consideration I believe, IoT role is embedded more and deeper into our lives, disaster relief efforts can be improved, helping all of those in need.

Studying public human behavior of a country has a positive effect on reducing disaster recovery time. Today, with technological advancement, acquiring information about any issue or disaster has been made easier. Even before the disaster occurs some people give less importance to any upcoming disaster as they think it is just a rumor. For some it is a natural disaster which cannot be stopped whatever precautions you take. But after disaster the situation is almost different because the victims need to suffer from a lot of difficulties for their families and the property they have lost during the disaster.

Trying not to forget indeed, the uprising pronounced role of the social media in grabbing the attention of the society, local and international governments to raise the funds for stepping out of any disaster whatever its weight with minimal casualties. Social media can offer the potential for disaster warnings to be conveyed to anybody with a particular account or device in a geographic region. Such an automatized warning framework would imply that clients don't need to sign up or decide to get these updates, in any case, rather would get the messages basically due to having the proper device and being in the disaster zone.

Social media can be utilized as a tool to detect disasters. It is additionally conceivable that disaster detection through social media listening activities can be created to screen social media streams and afterward recognize disasters and issue alarms depending on acknowledgment of social media content.

People of Iraq think that Facebook is an important and far better tool of social media to communicate during disaster. Facebook has the feature of getting the details from their users that ask the user of 'Feeling Safe' during the disaster. This will help the government organizations to gather the data of the affected areas and planning can be done to assist the victims. Beside this, in future, the pre-disaster plan can be framed out for the citizens of Iraq.

Citizens of Turkey, however, think that WhatsApp is a quick-to-go way of communication with their families and friends. WhatsApp can provide a feature in their application in which the user can have the option of marking their family members contact as the important one. Whenever any of the users get affected by the disaster, their important contacts will be notified on just one click.

All these measures taken by different organizations and especially top social media applications will aid in taking precautionary measures before any disaster and rescue operation during and after disasters.

Summarizing conclusions,

- a. Substantial number of people prefers to use mobile calls during a disaster.
- b. Most of them use the internet and social media, e.g. WhatsApp, Instagram, Facebook, Twitter, Snapchat, Viber, and Skype.
- c. The study showed quite different emotional and "psychological" attitude of the participants to the event of disaster.
- d. Therefore it is mandatory, in every community, to set up and ensure competent early disaster warnings, response and recovery programmes and facilities so that communities can tolerate, withstand, recover, and heal disaster aftermath, in a smooth and efficient fashion.

Based on the above findings, it is recommended that:

- i. It is quite essential and mandatory that health care personnel should have, in advance, well elaborated and documented solutions and treatment strategies,

and resources, to deal with the wide spectrum of psychological and / or behavioural changes disasters' sufferers may show.

- ii. Both, governments and private sector, are invited to set up, and keep renewing, the foundation and facilities for a competent system of IoT and social media communications.

Programmes should be set up to encourage various sectors of society to learn how to use IoT and social media in the event of disaster, i.e. spreading and teaching them how to use real time digital technologies and facilities.



REFERENCES

Books

- Chikezie E., U. (2018). The New (Social) Media: A contemporary introduction. In U. Chikezie E., Perspectives in Social Sciences (pp. 1-16). School of General Studies, Nnamdi Azikiwe University, Editors: C.E. Uzochukwu.
- Cooper D.R., S. P. (2010). Business Research Methods, 11th Edition. McGraw-Hill/Irwin.
- Gill J., a. J. (2010). Research Methods for Managers, 4th Edition. 1 Oliver's Yard 55 City Road London EC1Y 1SP.: SAGE Publications Ltd.
- Odhiambo, C. A. (2012). Social Media as a Tool of Marketing and Creating Brand Awareness. Rosmeriany Nahan-Suomela.
- Perry RW et al, G. K. (2008). Public Health Guide in Emergencies. Geneva: The Johns Hopkins Bloomberg School of Public Health, International Federation of Red Cross and Red Crescent Societies.
- Pine, J. C. (2018). Technology and Emergency Management. North Carolina: John Wiley & Sons, Inc.
- SAMHSA, S. A. (2014). Trauma-Informed Care in Behavioral Health Service: Understanding the Impact of Trauma. Rockville: NCBI Bookshelf.
- Siverman D. (2014). Interpreting Qualitative Data; Guide to the Principles of Qualitative Research. 5th Edition. 1 Oliver's Yard 55 City Road London EC1Y 1SP.: SAGE Publications Ltd.
- Ursano RJ, F. C. (2017). Individual and Community Responses to Disasters. In Textbook of Disaster Psychiatry (pp. 1–25). Cambridge University Press.

Periodicals

- A. Srikanth. (2012). Social media can solve many problems during natural disasters. ABIResearch. (2017, April 23). More than 30 billion devices will wirelessly connect to the Internet of everything in 2020.
- Ansell, C. B. (2010). Managing Transboundary Crises: Identifying the Building Blocks of an Effective Response System. Journal of Contingencies and Crisis Management, 195-207.
- Ashton, K. (2009). That 'Internet of Things' Thing. RFID Journal.

- Barr P. (2011). Staying connected Social media put to work when disaster strikes. Modern Healthcare.
- Bird, D. L. (2012). Flooding Facebook-the use of social media during the Queensland and Victorian floods. Australian Journal of Emergency Management, 27 (1), 27-33.
- Blanchard, H. e. (2010). The case for integrating crisis response with social media. The American Red Cross.
- Chavez, C. R. (2010). A New Way to Communicate with Residents: Local Government Use of Social Media to Prepare for Emergencies, 1-13.
- Damienne Provitolo, E. D.-P.-P. (2011). Emergent Human Behaviour During A Disaster: Thematic Versus Complex Systems Approaches. Vienna, Austria: Emergent Properties in Natural and Artificial Complex System.
- David Alexander. (2013). Social media in disaster risk reduction and crisis management. Springer Science Business Media Dordrecht 2013.
- Ejeta LT, A. A. (2015). Application of Behavioral Theories to Disaster and Emergency Health Preparedness: A Systematic Rewiew. PLOS Currents Disasters.
- Elsevier Science Ltd. (1997). International Astronautical Federation. Acra Astronautica. pp. 2-8, 291-325.
- Falkheimer, j. a. (2006). Multicultural Crisis Communication: Towards a Social Constructionist Perspective. Journal of Contingencies and Crisis Management, 180-189.
- Gao, H. B. (2011). Harnessing the crowdsourcing power of social media for disaster relief. CSDL Home IEEE Inteligent Systems, 10-14.
- Gershenfeld et al., N. K. (2004). Internet of things. Scientific American.
- Gregory RC, P. D. (2006). Disaster Medicine . Mosby Elsevier, 29.
- Gubbi et al., J. B. (2013). Internet of Things (IoT): A vision, architectural elements, and future directions. Future Generation Computer Systems. springer.
- Hughes, A. (2012). The evolving role of the public information officer. Journal of Homeland Security & Emergency Management, 1-20.

- INFSO, D. (2008). Networked Enterprise & RFID INFSO G. 2 Micro & Nanosystems, in co-operation with the Working Group RFID of the ETP EPOSS, Internet of Things in 2020, Roadmap for the Future [R]. Information Society and Media, Tech. Rep. springer.
- J John Wellington, P. R. (2017). Role of Internet of Things in disaster management. Institute of Electrical and Electronics Engineers.
- J. Brian Houston, J. H. (2014). Social media and disaster: a functional framework for social media use in disaster planing, response, and research. ResearchGate.
- Joshua C. Morganstein., a. R. (2020). Ecological Disasters and Mental Health: Causes, Consequences, and Interventions. *Frontiers in Psychiatry* .
- Kristensen P, W. L. (2014). Prevalence of psychiatric disorders and functional impairment after loss of a family member: a longitudinal study after the 2004 Tsunami. *pubmed*.
- L. Yang, S. Y. (2012). How the internet of things technology enhance emergency response operations. *Technological Forecasting & Social Change*.
- Lai BS, O. M.-B.-B. (2020). Violence victimization and negative health correlates of youth in post-earthquake Haiti: Findings from the cross-sectional violence against children survey. *Journal of Affect Disorders*.
- Larsson, L. (2008). Kris och Lärdom: kriskommunikation från Tjernobyl till Tsunamin. *Media and Communication Science*.
- Latonero, S. (2011). Emergency management, twitter and social media evangelism. *International Journal of Information Systems for Crisis Response Management*, 1-16.
- Lieberman, J. I. (2011). Understanding the power of social media as a communication tool in the aftermath of disasters. *Committee on Homeland Security and Governmental Affairs United States Senate One Hundred Twelfth Congress*, 1-126.
- Lindsay, B. (2011). Social media and disasters: Current uses, future options, and policy considerations. *Journal of Current Issues in Media and Telecommunications*, 287-297.

- M. Loveland. (2011). INFOGRAPHIC: How Social Media Is Used During A Natural Disaster.
- Mehdi Najafi, A. A. (2017). The Theory of Planned Behavior and Disaster Preparedness. PLOS CURRENTS DISASTERS.
- Muniz-Rodriguez K et al., O. S. (2020). Social Media Use in Emergency Response to Natural Disasters: A Systematic Review With a Public Health Perspective. . Disaster Med Public Health Prep. .
- North CS, P. B. (2013). Mental health response to community disasters: a systematic review. . JAMA, 507–518.
- Palen, L. &. (2007). Citizen communications in crisis: Anticipating a future of ICT-supported public participation. Natural Hazards, 727-736.
- Palen, L. A. (2010). A vision for technology-mediated support for public participation & assistance in mass emergencies & disasters. In Proceedings of the 2010 ACMBCS Visions of Computer Science Conference , 1-12.
- Palen, L. V. (2009). Social Science Computer Review. Crisis in a Networked World, 467-480.
- Palinkas LA, P. J. (1993). Community patterns of psychiatric disorders after the Exxon Valdez oil spill. Am J Psychiatry.
- Pogkas N. K. (2007). Architecture design and implementation of an Ad-Hoc network for disaster relief operations. IEEE Transactions on Industrial Informatics, 61-72.
- Starbird, K. M. (2012). Learning from the crowd: Collaborative filtering techniques for identifying on-the-ground Twitterers during mass disruptions. ISCRAM, 1-10.
- Ueyma, J. F. (2014). Exploiting the use of unmanned aerial vehicles to provide resilience in wireless sensor networks. . IEEE Communications Magazine, 81-87.
- Wang et al., J. R. (2008). Dynamic workflow modeling and analysis in incident command systems. IEEE Transactions on Systems, Man, and Cybernetics-Part A: Systems and Humans. springer.

- White, C. P. (2009). An online social network for emergency management. *International Journal for Emergency Management*, 369-382.
- Xu et al., L. H. (2014). Internet of things in industries: A survey. *IEEE Transactions on Industrial Informatics*. springer.
- Yates, D. &. (2011). Emergency knowledge management and social media technologies: A case study of the 2010 Haitian earthquake. *International Journal of Information Management*, 6-13.
- Yin, J. L. (2012). Using social media to enhance emergency situational awareness. *CSDL Home IEEE intelligent Systems*, 52-59.

Other Sources

- Babbie E.R. (2010). *The Practice of Social Research*. 12th Edition. Belmont, CA: Wadsworth Cengage: Muijs, Daniel. *Doing Quantitative Research in Education with SPSS*. 2nd edition. London. SAGA Publications. [online]. Retrieved from www.libguides.usc.edu: <https://libguides.usc.edu/writingguid>
- Erdelj M., N. E. (2016, February 15-18). UAV- assisted disaster management: Applications and open issues. Hawaii, United States of America.
- Diaz, P. I. (2013). Supporting Citizens 2.0 in disasters response. 7th International Conference on Methodologies (pp. 79-88). Pontevedra, Spain: Technologies and Tools Enabling E-Government (MeTTeG 2013).
- Frigerio, S. S. (2014). A web-based platform for automatic and continuous landslide monitoring: The Rotolon (Eastern Italian Alps) case study. *Computers & Geosciences*,. 96-105.
- Himadri Nath Saha, S. A. (2017). Disaster Management using Internet of Things. *Industrial Automation and Electromechanical Engineering Conference (IEMECON)*. Bangkok, Thailand: Research Gate.
- Hootsuite. (2018). *Social Media Trends*. Hootsuite 2018 Social Trends Survey.
- KentState University library. (2020,March). libguides.library.kent.edu/SPSS/PairedSamplestTest. Retrieved from www.kent.edu.
- Magsino, S. L. (2009). *Applications of Social Network Analysis for Building Community Disaster Resilience: Workshop Summary*. Washington, DC.

- Metova, C. (2020). Survey: Awareness of IoT remains low [online], second annual survey revealing, . <https://www.advanced-television.com/2019/06/12/survey-awareness-of-iot-remains-low/> [accessed 12 June 2019].
- National Research Council. (2011). Public Response to Alerts and Warnings on Mobile Devices.
- National Research Council. (2013b). Public Response to Alerts and Warnings Using Social Media.
- OCHA. (2017, February 13). Five Essentials for The First 72 Hours of Disaster Response. Retrieved from United Nation Office for the Coordination of the Humanitarian Affairs (OCHA) : <https://www.unocha.org/story/five-essentials-first-72-hours-disaster-response>
- Osofsky HJ, O. J. (2017). The Louisiana mental and behavioral health capacity project trauma-informed integrated care model and improved posttraumatic stress outcomes. *J Public Health Manag Pract.*
- Partha Pratim Ray, M. M. (2017). Internet of Things for Disaster Management: State of the Art and Prospects. *IEEE Access.*
- Saunders, M. (2010). Summary Research Methods for Business Students - English version [online]. Retrieved from www.worldsupporter.org: <https://www.worldsupporter.org/en/chapter/40519-summary-research-methods-business-students-saunders-et-al-english-version>.
- Starbird, K. (2010). Self-Organizing by Digital Volunteers in Times of Crisis. Vancouver, BC, Canada: Annual Chi Conference on Human Factors in Computing Systems.
- Terrell, K. (2015, June 16). The History of Social Media. Retrieved from History Cooperative: <https://historycooperative.org/the-history-of-social-media/>

APPENDICES



Appendix A.1 Survey Questions

Human Behavior with IoT & Social Media for Disaster Management

This questionnaire is carried out for the thesis study titled Human Behavior with IoT (Internet of Things) and Social Media for Disaster Management conducted by Bahçeşehir University (BAU) Institute of Natural and Applied Sciences.

The information to be obtained from you will be used for scientific purposes. Your contributions are important to us.

Thank you for your valuable contribution

PERSONAL INFORMATION							
Please select the appropriate answer (√)							
Q1.Gender	Female		Male		Prefer not to say		
Q2.Age	17-24	25-31	32-38	39-45	46 and Above		
Q3.Education Level	Master or higher	University	High school	Read and Write only			
Q4.Country	Turkey	Iraq	Others				
Q5.Residency	Rural inhabitant	House	Building	Campus			
	Urban inhabitant	House	Building	Campus			
Q6.How many hours per day do you spend on social network sites?			0-1	2-3	4-5	More than 6 hours	It depends on the need
Q7.Since when did you start using social media?			3-6 Months	1-2 years	3-4 years	More than 5 years	
Q8. Have you ever experience or have been part of any kind				Yes	No	I don't remember	

of disasters?			
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Q8.A. If yes, what kind of natural disasters you have experienced? (You can choose more than one)

Tornadoes & Severe Storms	Hurricanes & Tropical Storms	Floods	Wildfires	Earthquakes	Drought	Other
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Q8.B. If yes, what kind of man-made disasters you have experienced? (You can choose more than one).

Hazardous material spills	Fire s	Groundwater r contamination	Transportation n accidents	Structural e failures	Mining accidents	Explosions	Acts of terrorism	Other
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Q9. Did you take any disaster management program in your school, college or office?	Yes	No
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Section A: Questionnaire about the IoT (Internet of Things) and the use of it in Disaster Management levels (Prevention and Mitigation, Preparedness, Response, Recovery)

IoT: Devices or objects are made of smart objects, which are connected to the internet and we can use it in many domains for examples (Early Warning Systems, Smart Cities, Control home system).

Please read the below questions, and select the appropriate answer (√)

1- Is the internet service available efficiently and continuously on your country?	No	Sometimes	Yes
2- Is infrastructure for IoT is available in your city?	No	I have no idea	Yes
3- Do you use internet network to learn about weather news and conditions?	No	Sometimes	Yes
4- IoT creates positive attitudes to reduce disaster consequence?	Disagree	I have no Idea	Agree
5- IoT sensors may be having negative effect on people health?	Disagree	I have no Idea	Agree
6- IoT increases productivity of social media?	Disagree	I have no Idea	Agree
7- Are you going to use IoT technology to control your home equipment?	No	May be in the future	I use it already

Section B: Social Media Part
PART I. Pre-Disaster

Questionnaire about use of Social Media Before disaster occurs (Hours to days):
Please select the appropriate answer.

1.A. Which type of mobile applications would you favor to use to communicate with your relatives or friends frequently? (You can choose more than one).

Twitter	Facebook	Instagram	WhatsApp	Snapchat	Skype	Viber	Others
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1.B. Which mobile application do you prefer to use it first?

2. Which communication methods do you prefer to receive news frequently? (You can choose more than one option) Q2.SM.B

Social media	TV	Radio	SMS mobile	Siren	Newspaper	Webpages	Other
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3. Which option would you like to use to communicate with your relatives or friends frequently? (You can choose more than one).

Mobile call	SMS	Personal message on social media ex. Twitter, WhatsApp, F.B Messenger, etc...	Public post on social media ex. Twitter, Instagram, Facebook, etc...	Other
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4. If you hear that a natural disaster will hit your living area will you search on the Internet for different precautionary measures?	No	May be	Yes
5. Do you provide any disaster precautionary measures on social media?	No	May be	Yes
6. Do you think that you will receive any disaster warning from social media?	No	May be	Yes

PART II: During-Disaster (Event)

Questionnaire about use of Social Media During disaster occurs (Hours to days):
Please select the appropriate answer.

1. Which device do you use it to log on social media during disaster?

Mobile device	Tablet	Laptop	Desktop computer	Other
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2. Which option would you like to use to communicate with your relatives or friends frequently? (You can choose more than one).

Mobile call	SMS	Personal message on social media ex. Twitter, WhatsApp, F.B Messenger, etc...	Public post on social media ex. Twitter, Instagram, Facebook, etc...	Other
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3.A. Which type of mobile applications would you favor to use to communicate with your relatives or friends frequently? (You can choose more than one).

Twitter	Facebook	Instagram	WhatsApp	Snapchat	Skype	Viber	Others
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3.B. Which mobile application do you prefer to use it first?

4. Will you send or receive request for help or assistance on social media?	No	May be	Yes
5. Will you try to document and know what is happening on social media during the disaster?	No	May be	Yes
6. Will you try to Inform others about one's own condition and location and learn about a disaster-affected individual's condition and location by using social media?	No	May be	Yes

PART III: Post-Disaster

Questionnaire about use of Social Media After disaster occurs (Hours to days):
Please select the appropriate answer.

1. Which option would you like to use to communicate with your relatives or friends frequently? (You can choose more than one).

Mobile call	SMS	Personal message on social media ex. Twitter, WhatsApp, F.B Messenger, etc..	Public post on social media ex. Twitter, Instagram, Facebook, etc..	Other
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2.A. Which type of mobile applications would you favor to use to communicate with your relatives or friends frequently? (You can choose more than one).

Twitter	Facebook	Instagram	WhatsApp	Snapchat	Skype	Viber	Others
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2.B. Which mobile application do you prefer to use it first?

3. Will you try to help rescue teams by sending reports or videos or pictures on social media?	No	May be	Yes
4. Will you use social media to spread information about affected or rescue places?	No	May be	Yes
5. Will you Provide and receive information about (and discuss) disaster response, recovery, and rebuilding; tell and hear stories about the disaster on social media?	No	May be	Yes
6. Would you prefer to Raise and develop awareness of an event; donate and receive donations; identify and list ways to help or volunteer on social media?	No	May be	Yes
7. Will you try to document or inform people or give advice or follow the news at that time on social media?	No	May be	Yes

Section C: Human behavior (before, during, after) disaster occur PART I. Pre-Disaster

Questionnaire about the acute stressful symptoms before a disaster occurs (Hours to days):
Suppose you've been told that a serious tragedy and traumatic event will happen soon (like earth quick, flooding, volcano, fire, etc.)

Please answer the below questions concerning your emotional state at that time and

Choose the most appropriate answer (✓)

N	Questions	Not at all	A little bit	Moderately	Quite a bit	Extremely
1.	Will you get worried as you hear a stressful event is happening soon?					
2.	Do you feel very emotionally upset when something reminded you of the stressful event?					
3.	Do you feel like you are detached or distant from yourself, your body, your physical					

	surroundings or your memories?					
4.	Do you try to avoid thoughts, feelings, or physical sensations that reminded you of the stressful event?					
5.	Being "super alert," on guard, or constantly on the lookout for danger					
6.	Do you feel jumpy or easily startled when you hear an unexpected noise?					
7.	Do you get extremely irritable or angry at any point where you scream on other people, get into fights, or destroyed things?					

PART II: During-Disaster (Event)

Questionnaire about the acute stressful symptoms during the traumatic event: Suppose you've experienced a serious tragedy traumatic event (like earth quick, flooding, volcano, fire, etc.) Please answer the below questions concerning your emotional state at that time.

Choose the most appropriate answer (✓)

N	Questions	Not at all	A little bit	Moderately	Quite a bit	Extremely
1.	Are your worries about the event reaching the degree of panic attack?					
2.	Feeling very emotionally upset when you are experiencing the traumatic event?					
3.	Feeling detached or distant from yourself, your body, your physical surroundings, or your memories?					
4.	Trying to avoid thoughts, feelings, or physical sensations that you're experiencing during the stressful event?					
5.	Being "super alert," on guard, or constantly on the lookout for danger?					
6.	Feeling jumpy or easily startled when you hear an unexpected noise?					
7.	Being extremely irritable or angry to the point where you yelled at other people, got into fights, or destroyed things?					

PART III: Post-Disaster

Questionnaire about the acute stressful symptoms after the traumatic event:
Suppose you've experienced a serious tragedy traumatic event (like earth quick, flooding, volcano, fire, etc.).

Please answer the below questions concerning your emotional state after the event had been finished.

Chose the most appropriate answer (✓)

N	Questions	Not at all	A little bit	Moderately	Quite a bit	Extremely
1.	Having "flashbacks," that is, you suddenly acted or felt as if a stressful experience from the past was happening all over again (for example, you re-experienced parts of a stressful experience by seeing, hearing, smelling, or physically feeling parts of the experience)?					
2.	Feeling very emotionally upset when something reminded you of a stressful experience?					
3.	Feeling detached or distant from yourself, your body, your physical surroundings, or your memories?					
4.	Trying to avoid thoughts, feelings, or physical sensations that reminded you of a stressful experience?					
5.	Being "super alert," on guard, or constantly on the lookout for danger?					
6.	Feeling jumpy or easily startled when you hear an unexpected noise?					
7.	Being extremely irritable or angry to the point where you yelled at other people, got into fights, or destroyed things?					

Thank You For Your Time

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