

## Chapter One

### 1.1 Background to the Study

A disaster is defined as "a significant disruption of a community's or society's functioning that results in widespread human, material, economic, or environmental losses and impacts that exceed the affected community's or society's ability to cope using its own resources." 1. Additionally, disaster can be defined as an unexpected and calamitous event that significantly impairs the functioning of a community or society. Typically, such incidents result in massive loss of human life, property, and the environment, far exceeding the community's capacity to manage using only its own resources. Natural disasters and human actions can both contribute to disasters. When a hazard affects vulnerable people, a disaster is said to have occurred. 'Disaster occurs when hazards, vulnerability, and an inability to mitigate risk's potential negative consequences combine. 1. However, four stages have been identified in a 'disaster cycle': mitigation and prevention, preparedness, response, and recovery.

Scholars have defined disaster from a variety of perspectives throughout history. Defining disasters aids in the comprehension of their theory and methodology. Throughout the early decades, disaster research was typically limited to an implicit or partial examination of a disaster phenomenon. 2. Numerous glossaries exist for disaster-related terms and concepts. In attempting to compile key disaster-related terms, researchers discovered that the term "disaster" has numerous definitions. 2 and 3. Without a precise and widely accepted definition, disaster research has become problematic. 4, 5, and 6. This issue arose as a result of the term's use in a variety of professional contexts. Other scholars emphasized the

importance of standardizing definitions in order to provide a consistent framework for event reporting, data collection, and planning. 4.

Additionally, scholars recognized that 'a disaster is a product of its consequences' and that 'if the walls survive the earthquake and the dam retains the water, no disaster occurs.' Rather than that, disaster is defined as the 'collapse of cultural protections.' 5. The implication is that a disaster is any occurrence that has significant negative and undesirable consequences. This may be the result of natural disasters (such as earthquakes, floods, and severe weather events), technological malfunctions, or incidents involving war and violence. 5, 6. Other scholars began to depart from this perspective, distinguishing disasters from other occurrences (such as civil disorders and wars) 7. However, another scholar casts doubt on the 'practice of defining disasters based on the agent's surface characteristics. 8. Natural and man-made disasters have increased in frequency over the last few decades. Over 50 million people are believed to live in conflict zones, while another 100 million are impacted by natural disasters on a yearly basis. Between 1994 and 2013, natural disasters affected approximately 218 million people worldwide, claiming 1.35 million lives<sup>9</sup>. Between 1980 and 2012, the global cost of disasters totaled US\$3.8 trillion in 2012 dollars. 9. Additionally, these reports indicated a significant increase in human fatalities and financial losses as a result of population growth and ineffective urban planning in high-hazard areas, such as flood plains or earthquake zones. Often, disasters have a greater impact on developing countries than on developed countries – "more people die in low-income countries than in high-income countries per disaster." 10. Numerous Asian countries are impacted by earthquakes and tsunamis, prolonged droughts and excessive flooding, radiation exposure from nuclear power plant meltdowns, cross-border haze from slash and burn activities,

hurricanes and typhoons, landslides, volcanic activity, and severe weather. These events have wreaked havoc and displaced tens of thousands of people in a number of countries. For example, in 2004, the Indian Ocean Tsunami, triggered by a 9.0 magnitude earthquake, claimed an estimated 250,000 lives in a single day, displacing over 1.7 million people and causing \$15 billion in damage. Additionally, the tsunami wreaked havoc on the environment and human health. It was the most destructive tsunami in recent history, affecting approximately 18 countries throughout Southeast Asia, South Asia, and coastal Africa<sup>10</sup>.

Disasters strike unexpectedly and vary in severity, posing a significant obstacle to effective information exchange and coordination<sup>10</sup>. In disasters, lives are irreversibly shattered, livelihoods are destroyed, and people are displaced, with many unable to return to their pre-disaster normal lives – posing significant socio-psychological difficulties for the victims. The impact is not limited to the victims; victims' families, friends, first responders, and caregivers all face extremely unpleasant situations. Due to the scale of these disasters, it has become clear that disaster communication and management strategies must be more coordinated and effective<sup>11</sup>.

These strategies will significantly aid in managing vulnerabilities and minimizing the impact of disasters on people and social systems. In this context, ethical decisions may have significant and long-lasting effects on the communities served<sup>12</sup>. Communication is critical during and immediately following a disaster, as it connects disaster victims with first responders, support systems, and other family members<sup>13</sup>. Communication is a potentially valuable tool for avoiding and mitigating disaster-related harm. Meanwhile, disaster victims communicate effectively with first responders, support systems, and other family members. As such, a community's resilience requires dependable and accessible communication and

information systems<sup>14</sup>. This significance was amplified by disasters like Hurricane Katrina and the 9/11 terrorist attacks<sup>15</sup>.

Numerous disaster scholars have noted a significant increase in demand for information about disaster-affected and unaffected communities<sup>16</sup>. Indeed, it would not be an exaggeration to say that there is a frenzy of information gathering from surviving victims, their family and friends, and interested stakeholders such as the various disaster response agencies. According to some studies, community members lack the ability to aggregate and authenticate information, and thus informal communication cannot be automatically classified as formal <sup>17, 18</sup>. As a result of these information gaps, ongoing organization, credibility monitoring, and additional verification are required to establish and disseminate reliable disaster communication for information seekers <sup>19, 20</sup>. In comparison to mass media, information seeking is likely to have a positive outcome when local individuals serve as sources of information <sup>21</sup>. When information becomes fragmented, scarce, or even incorrect, affected communities are prone to merge and rely on others as reliable information sources<sup>22</sup>.

Trustworthiness of information is critical for effective disaster response actions during disasters. Affected individuals rely on information they believe is reliable. It is improbable that they will pay much attention to and act on information provided by someone in whom they lack trust – a situation that will prevent the given information from being transformed into usable knowledge <sup>23</sup>. Thus, trust and trust building are necessary preconditions for prompt decision-making in crisis situations<sup>24</sup>. Trust contributes to the information's perceived worthiness in the eyes of the affected people, as well as to the overall quality of the communication process and the efficiency of the information seeking process <sup>25</sup>.

Typically, humanitarian agencies (many of which are international in origin) play critical roles in disasters, not only by providing material and socio-psychological assistance to affected individuals, but also by providing critical specialized technical assistance to local teams engaged in disaster rescue efforts. However, as a result of their foreign origin and possibly a lack of familiarity with indigenous knowledge, customs, and sensitivities, humanitarian agencies frequently struggle to build trust within the affected community 23,25. Developing trust takes time and requires a relationship with the targeted groups of people. However, disasters occur unexpectedly, and humanitarian agencies typically enter disaster-affected areas shortly after a disaster occurs, frequently with little knowledge of the target communities they are assisting. Thus, to bridge this knowledge gap, these humanitarian agencies should involve local support agencies, as they will be better equipped to identify appropriate local knowledge and thus expedite the trust-building process<sup>26</sup>

By utilizing communications, the public should be informed on a regular basis via advisories about events such as 'an electrical grid failure or prolonged power outage, during which boil water orders may be required, or to remind people not to use generators or power cleaners indoors or near open windows to avoid carbon monoxide poisoning following a tropical storm, earthquake, or flood,' etc. 27,28. For disasters that occur with sufficient warning time, such as tropical storms, hurricanes, typhoons, and cyclones, or even tsunamis following a distant earthquake, weather reports and advisories would communicate who, when, and how residents should prepare, who may need to evacuate, who may be at risk of flooding, and where residents should seek shelter. 29.

Risk communication, as part of the communication system, aims to inform the public about the effects of an event and how their actions may affect the event's outcome. Emergency and

Crisis CERC is the practice of using risk communication in emergencies to inform the public about an event or issue and to empower community members to protect themselves. We focus on CERC in the context of disasters, at all stages of the disaster cycle, in this review. Historically, risk communication in disasters has been a one-way communication between authorities and the public, rather than an interactive flow of information. Disaster risk communication can take place via a variety of different channels, some of which have been developed or expanded recently. Face-to-face conversations, telephone calls, group meetings, artificial intelligence, mass media such as television, tailored mass media such as reverse 911 services, and interactive social media such as Twitter are all possible modes of communication. Numerous possible outcomes could be used to determine the effectiveness of risk communication interventions. We chose to focus on health outcomes (e.g., injuries, deaths), as these are the most likely to be measured and reported, and may also be considered the most important<sup>30</sup>.

Artificial Intelligence (AI) has advanced significantly since its inception, owing to the efforts of dedicated researchers. AI became truly fascinating to researchers in 1943, with the invention of the computer. Artificial Intelligence, or AI for short, is the intelligence possessed by machines and the branch of computer science dedicated to its development. Artificial intelligence is a synthesis of computer science, physiology, and philosophy, as well as mathematics and a few other disciplines<sup>31</sup>. It is a broad subject that encompasses a variety of fields, ranging from machine vision to expert systems. The common denominator among the fields of AI is the development of machines capable of "thinking." It is the branch of computer science concerned with the development of machines capable of engaging in behaviors deemed intelligent by humans. AI's primary objective is to create

intelligent machines<sup>31</sup>. Intelligence should be demonstrated through reasoning, decision-making, problem-solving, and, most importantly, through learning. Since ancient times, humans have been fascinated by the ability to create intelligent machines, and with the advent of the computer and 50 years of research into AI programming techniques, the dream of intelligent machines is becoming a reality. Researchers are developing systems capable of mimicking human thought, comprehending speech, defeating the world's best human chess player, and a host of other previously unimaginable feats. Thus, regardless of the definition, AI systems can be broadly defined as systems that think like humans, act like humans, think rationally, and act rationally. There are two types of strong AI: human-like AI, in which the computer program thinks and reason like a human being, and machine-learning AI, in which the computer program thinks and reason like a machine. While Non-human-like AI believes that creating human-level intelligence in machines is not possible, Weak AI believes that AI techniques can be developed to solve a variety of real-world problems<sup>32</sup>.

Today, in the pursuit of intelligent machines, the field of artificial intelligence has fragmented into distinct approaches or techniques based on divergent viewpoints among researchers regarding the most promising methods and theories. These techniques may be considered components of AI<sup>31</sup>. Expert Systems, Neural Networks<sup>8</sup>, Fuzz Logic, and Genetic Algorithms<sup>30</sup> are some of the techniques or methods. However, researchers primarily employ two fundamental strategies: bottom-up and top-down. Finally, the technology for simulating intelligent behavior became available. Over the next four decades, despite numerous setbacks, AI has grown from a dozen researchers to thousands of engineers and specialists; and from checkers programs to disease diagnosis systems, expert security systems, and the like<sup>33</sup>.

The origins of AI can be traced back before the invention of electronics, to philosophers and mathematicians such as Boole and others who theorized on principles that became the basis for AI Logic. This topic aims to convey the exciting possibilities associated with Artificial Intelligence and its applications. The link between human intelligence and machines was first observed in the early 1950s. Norbert Wiener was one of the first Americans to observe the principle of feedback theory, and the term artificial intelligence was coined in 1956 at the Dartmouth conference organized by John McCarthy, widely regarded as the father of AI<sup>32</sup>.

AI is excellent at problem solving as long as the problem is focused and well defined. Mathematicians, scientists, and engineers, for example, are frequently tasked with proving theorems. (A theorem is a mathematical assertion that is embedded within a larger theory or structure of ideas.) Due to the large and complex formulas involved in such tasks, this can take an enormous amount of time, thought, and trial and error. A custom-built AI program can simplify and reduce such formulas in a fraction of the time required by human workers<sup>34</sup>.

AI can also assist with planning issues<sup>35</sup>. Effective step-by-step sequences of actions with the fewest possible steps and at the lowest possible cost are critical in business and manufacturing operations. A program for artificial intelligence can be designed to encompass all possible steps and outcomes. Additionally, the programmer must establish some criteria for evaluating the outcome, such as whether speed is more important than cost in accomplishing the task, or whether the lowest cost is the desired outcome regardless of the duration<sup>35</sup>. This type of AI program will generate a plan faster than traditional methods. The overarching problem of developing (or simulating) intelligence has been subdivided

into a number of distinct sub-problems. These are specific characteristics or capabilities that researchers desire an intelligent system to exhibit. The following constructs have received the most attention<sup>36</sup>.

The representation of knowledge and the engineering of knowledge are central to AI research. Numerous problems that machines are expected to solve will necessitate in-depth knowledge of the world. Objects, properties, categories, and relations between objects; situations, events, states, and time; causes and effects; knowledge about knowledge (what we know about what other people know); and a variety of other, less well-researched domains are among the things that AI must represent. An ontology (to borrow a term from traditional philosophy) is a comprehensive representation of "what exists," the most general of which are referred to as upper anthologies<sup>37</sup>. Default reasoning and the qualification problem are two of the most difficult problems in knowledge representations. Numerous facts about people are based on "working assumptions." For instance, when the subject of birds comes up in conversation, most people envision an animal the size of a fist that sings and flies. None of these statements is true of all birds. John McCarthy coined the term "qualification problem" in 1969 to describe this issue: for any commonsense rule that AI researchers care to represent, there are typically a large number of exceptions. Almost nothing is simply true or false in the manner required by abstract logic. Numerous solutions to this problem have been investigated in AI research.

Much of what people know is not expressed verbally as "facts" or "statements." For instance, a chess master may avoid a certain chess position because it "feels too exposed," or an art critic may take one look at a statue and immediately recognize it as a forgery. These are

unconscious and sub-symbolic intuitions or tendencies that are represented in the brain. This type of knowledge informs and contextualizes symbolic, conscious knowledge.

Machine learning has been at the heart of AI research since its inception. Unsupervised learning is the capability of a computer to discover patterns in a continuous stream of input. Classification and numerical regression are both types of supervised learning. Classification is used to determine the category to which something belongs after viewing several examples of items belonging to various categories..

Regression takes a set of numerical input/output examples and attempts to find a continuous function that generates the outputs from the inputs. The agent is rewarded for correct responses and punished for incorrect ones in reinforcement learning. These can be analyzed using decision theory concepts such as utility. Computational learning theory is a subfield of theoretical computer science concerned with the mathematical analysis of machine learning algorithms and their performance. Pattern Recognition is a subset of machine learning in which an output value (or label) is assigned to a given input value (or instance) using a specific algorithm. The general goal of pattern recognition algorithms is to provide a reasonable response to all possible inputs and to perform "fuzzy" matching of inputs. Speech recognition, handwriting recognition, face recognition, or optical character recognition are all examples of recognition. Automatic speech recognition, text classification into multiple categories (e.g. spam/non-spam email messages), automatic recognition of handwritten postal codes on postal envelopes, and automatic recognition of images of human faces are all examples of pattern recognition applications. Classification is a type of pattern recognition that attempts to assign each input value to one of a given set of classes (for example, determine whether a given email is "spam" or "non-spam"). However,

pattern recognition is a broader problem that encompasses a variety of different types of output. Additionally, regression assigns a real-valued output to each input; sequence labeling assigns a class to each member of a sequence of values (for example, part of speech tagging assigns a part of speech to each word in an input sentence); and parsing assigns an input sentence a parse tree describing the sentence's syntactic structure<sup>37</sup>.

Diagnosis as an artificial intelligence tool is concerned with the development of algorithms and techniques for determining whether a system's behavior is correct. If the system is not operating properly, the algorithm should be able to determine as precisely as possible which component of the system is failing and what type of fault it is experiencing. The computation is based on observations of current behavior. Expert diagnosis (or expert system diagnosis) is based on the expert's experience with the system. Using this knowledge, a mapping is constructed that efficiently associates observations with their associated diagnoses. A diagnostic procedure is illustrated by the actions of a garage mechanic with an automobile. The mechanic will begin by attempting to identify any abnormal behavior based on his observations of the vehicle and his familiarity with this type of vehicle. If the mechanic determines that the behavior is abnormal, he will attempt to refine his diagnosis through additional observations and possibly testing the system until he locates the faulty component. This means that the mechanic is critical to the vehicle's diagnosis<sup>38</sup>.

Intelligent agents must be capable of setting and achieving goals. They require a means of visualizing the future (they must have a representation of the state of the world and the ability to predict how their actions will affect it) and the ability to make choices that maximize the utility (or "value") of available options. must adapt its strategy as circumstances dictate, requiring the agent to reason in the face of uncertainty. Multi-agent

planning makes use of the cooperation and competition of numerous agents to accomplish a task. Evolutionary algorithms and swarm intelligence both make use of emergent behavior. In classical planning problems, the agent can assume that it is the only entity acting on the world and can predict the possible consequences of its actions. If this is not true, it must periodically determine whether the world conforms to its predictions and it<sup>39</sup>.

Natural language processing (NLP) demonstrates that machines are capable of reading and comprehending the languages spoken by humans. Numerous researchers hope that a sufficiently powerful natural language processing system will be capable of self-learning by reading existing text available on the internet. Natural language processing has a number of straightforward applications, including information retrieval (or text mining) and machine translation. NLP is a technique used in artificial intelligence and a branch of computer science and linguistics that studies the interactions between computers and human (natural) languages. Natural language processing is an extremely appealing method of human–computer interaction in theory. Natural language comprehension is occasionally referred to as an AI-complete problem due to the apparent requirement for extensive knowledge of the external world and the ability to manipulate it<sup>39</sup>.

Computational creativity is a term that encompasses the fields of artificial intelligence, cognitive psychology, philosophy, and the arts. The objective is to model, simulate, or replicate genuine creativity using computers in order to accomplish one of several goals: 25 to develop a program or computer capable of human-level creativity; to gain a better understanding of human creativity and to formulate an algorithmic perspective on human creative behavior; to develop programs capable of enhancing human creativity without necessarily being creative themselves. The field of computational creativity is concerned

with the theoretical and practical aspects of creativity research<sup>38</sup>. Theoretical work on the nature and proper definition of creativity is carried out concurrently with practical work on the implementation of creative systems, with one strand informing the other.

Social intelligence provides an explanation. Emotional and social abilities serve a dual purpose for an intelligent agent. To begin, it must be capable of forecasting others' behavior by comprehending their motivations and emotional states. (This encompasses aspects of game theory and decision theory, as well as the ability to model human emotions and the perceptual abilities necessary to detect emotions.) Additionally, for effective human-computer interaction, an intelligent machine must exhibit emotions. It must at the very least appear courteous and sensitive to the humans with whom it interacts. At the very least, it should exhibit normal emotions. The majority of researchers hope that their work will eventually be incorporated into a machine with general intelligence (commonly referred to as strong AI), capable of combining all of the skills above and exceeding human abilities in the majority, if not all, of them. A few believe that such a project would require anthropomorphic features such as artificial consciousness or an artificial brain.

At the moment, artificial intelligence systems are capable of performing the following tasks: playing a decent game of table tennis, driving safely along a curving mountain road, purchasing a week's worth of groceries online, playing a decent game of bridge, providing competent legal advice in specialized areas of law, and translating English into other languages in real time. Additionally, Deep Blue defeated reigning world chess champion Garry Kasparov in 1997; EQP solved a decades-old mathematical (Robbins) conjecture in 1997; Alvin in Navlab drives autonomously 98 percent of the time between Pittsburgh and San Diego); During the 1991 Gulf War, US forces deployed an AI logistics planning and

scheduling program that managed up to 50,000 vehicles, cargo, and people; NASA's on-board autonomous planning program managed the scheduling of spacecraft operations; and Proverb solved crossword puzzles better than the majority of humans in 1991. Using fuzzy logic, artificial intelligence has simplified the process of stabilizing camcorders<sup>39</sup>. As demand for AI-related technology increases, new advancements become available. Inevitably, AI has had and will continue to have a negative impact on lives<sup>37</sup>. The thermostat is the most well-known application of feedback theory: It regulates the temperature of an environment by gathering information about the actual temperature in the house, comparing it to the desired temperature, and responding by increasing or decreasing the heat. What made Wiener's research into feedback loops so significant was that he postulated that all intelligent behavior is the result of feedback mechanisms. In late 1955, Newell and Simon created The Logic Theorist, widely regarded as the first artificial intelligence program. The program would attempt to solve each problem by selecting the branch that would most likely result in the correct conclusion. The first version of a new program called The General Problem Solver (GPS) was evaluated in 1957. The program was created by the same team that created the Logic Theorist. The GPS was an extension of Wiener's feedback principle, capable of resolving a broader range of everyday problems<sup>35</sup>. IBM hired a team to conduct artificial intelligence research a few years after the GPS. Herbert Gelernter worked on a program for solving geometry theorems for three years. While more programs were being developed, McCarthy was hard at work on a major breakthrough in the history of artificial intelligence. McCarthy announced his new invention, the LISP programming language, in 1958. The language is still in use today. LISP was quickly adopted as the preferred programming language for the majority of AI developers,

and Artificial Intelligence has grown in popularity since then as a result of the theories and principles developed by its dedicated researchers<sup>38</sup>. Artificial intelligence applications incorporate a variety of techniques, including expert/knowledge systems, neural networks, case-based reasoning, pattern matching, machine learning, and fuzzy logic.

All Artificial Intelligence computer programs are based on two fundamental components: a knowledge base and the ability to infer, i.e., make inferences based on logic and prior knowledge. A knowledge base is composed of numerous discrete units of information—facts, concepts, theories, procedures, and relationships—all of which are pertinent to a particular task or aspect of the world.

Programs are written to enable the computer to manipulate this data and reason, reach conclusions, and choose solutions to the problem at hand, such as determining whether a series of credit-card transactions involves fraud or driving an automated rover across a rocky Martian landscape<sup>40</sup>. Numerous other applications of artificial intelligence exist, including problem solving in mathematics and other disciplines, expert systems in medicine, natural language processing, robotics, and education. The ability of some AI programs to solve problems using facts rather than a predetermined set of steps most closely resembles "thinking" and leads some in the AI field to argue that such devices are indeed intelligent<sup>40</sup>.

Expert systems are a top-down approach that uses computer programs to attempt to mimic the behavior of the brain. This method employs serial processing and can be very well organized in order to complete the treatment. An expert system is a type of artificial intelligence program that possesses expert-level knowledge about a specific domain and understands how to apply that knowledge appropriately. The source of knowledge may be a

human expert or a book, for example. The term "domain" refers to the geographic area in which a task is performed<sup>35, 37</sup>.

The purpose of this artificial intelligence application is not to replace our human experts, but to make their knowledge and experience more accessible to a broader audience. According to Stanford University's Edward Feigenbaum, an expert system is "an intelligent computer program that employs knowledge and inference procedures to solve problems that are difficult enough to resolve without significant human expertise." <sup>42</sup>. AI is pursuing both scientific and engineering objectives. Additionally, diverse tools are used in AI research. Search and optimization, propositional logic, first-order logic, fuzzy logic, default logics, case-based reasoning, probabilistic methods for uncertain reasoning, classifiers and learning methods, neural networks, and genetic algorithms are the most frequently used tools in AI. These tools simultaneously define the methods used in applications and the approach taken to the problem at hand<sup>43</sup>.

Extreme events, such as flooding, are expected to become more frequent and intense as a result of climate change. Flooding has a massive economic impact and claims millions of lives worldwide. The number of large-scale natural disasters has increased significantly in recent years, resulting in significant impact on human lives, the environment, and buildings, as well as significant damage to societies<sup>41,43</sup>. During these disasters, massive amounts of data on the event's characteristics are collected by governmental agencies, society (e.g., citizen science), emergency responders, loss adjusters, and social media users. However, there is a dearth of research on how this data can be used to inform how various stakeholders are/may be affected directly or indirectly by large-scale natural disasters prior to, during, and after the event. The use of Artificial Intelligence (AI) techniques that put

large-scale natural disaster data into practice and provide appropriate tools for natural disaster forecasting, impact assessment, and societal resilience is gaining popularity and importance. This in turn informs resource allocation, which can result in increased preparedness and prevention for natural disasters, save lives, mitigate economic impact, improve emergency response, and strengthen and resilient communities<sup>44</sup>.

The majority of research in the field of artificial intelligence in flooding has focused on the use of social media (e.g., Facebook, Twitter, or Instagram), where status updates, comments, and photo sharing have been used to improve flood modeling and risk management<sup>33,35</sup>. A study examined the use of algorithms based on shared ground photography on social media.<sup>45</sup> Additionally, the use of specific algorithms for satellite or aerial imagery to detect flood extent was investigated. Due to the complexity of the imagery acquired in urban areas<sup>47</sup>, the resolution of the imagery collected is critical for detecting features of interest. Several studies have concentrated on the analysis of high-resolution, real-time data processing in order to derive flood data<sup>47,48</sup>.

The majority of disaster monitoring methods are based on change detection algorithms, which identify the affected area through a complex elaboration of pre- and post-event images. Change detection can be used on amplitude or intensity values, as well as filtered or elaborated versions of the amplitude <sup>49</sup>. For instance, to address change detection <sup>50</sup>, a technique based on change detection was developed and applied to quantities related to the observed surface's fractal parameters. The Glove vectors were used to initialize the word embedding, and finally, the image and text features were concatenated to determine the sample's probability, including information about flooding. Similarly, an AI system was developed to retrieve social media images containing direct evidence of flooding events and,

using a multimodal approach, derive visual properties of the images and associated metadata 51. To accomplish this, an image pre-processing step was implemented, which included cropping and pre-filtering test sets based on image color or textual metadata, as well as ranking for fusion. End-to-end learning was performed using Convolutional Neural Networks and Relation Networks for disaster image retrieval and flood detection from satellite images. 51. The purpose of this study is to ascertain the perceived ease of use of artificial intelligence systems and their applicability to disaster communication practices in Nigeria.

Act 12 as amended by Act 50 of 1999 established the National Emergency Management Agency to manage disasters in Nigeria. As a result, NEMA has been addressing disaster-related issues since its inception through the establishment of concrete structures and measures. Such measures as public education to increase public awareness and mitigate the effects of disasters in the country. Additionally, the Agency has established structures that enable it to rapidly detect, respond to, and combat disasters. With the Federal Government and other stakeholders in Disaster Management continuing to provide overwhelming support, NEMA will continue to improve its capability and effectiveness in carrying out its responsibilities with zeal.

Since its inception in 1999, NEMA has been actively involved in providing timely assistance to victims on both a national and international scale. The Agency has provided relief supplies to disaster victims in a variety of states across the country in response to a variety of national emergencies. Additionally, the Agency has facilitated the resettlement of Internally Displaced Persons (IDPs). An estimated 2,928 returnees were housed in a camp for three days, fed, given relief supplies and medical attention, and assisted with

transportation costs to return to their respective states. Additionally, approximately 17,000 Nigerians are being evacuated from the Mambilla Plateau and surrounding areas due to communal clashes and seeking refuge in Cameroon. Through NEMA, the federal government has a mandate to assist states and local governments with disaster response and recovery. In accordance with this mandate, recovery personnel at the National Emergency Coordination Centre (NECC) are required to closely monitor response activities and collect valuable data on the severity and intensity of the event, the affected geographic area, and any unmet critical needs of the affected population.. Another agency that will be surveyed in this study is the Nigerian meteorological Agency (NIMET).

The Nigerian Meteorological Agency (NIMET) was established by the National Assembly through the NIMET (Establishment) ACT 2003, which was enacted on 21st May 2003 and took effect on 19th June 2003 following Presidential assent. It is a Federal Government agency tasked with advising the President on all aspects of meteorology; developing, preparing, and interpreting government policy in the field of meteorology; and issuing weather (and climate) forecasts for the safe operation of aircraft, ocean-going vessels, and oil rigs. Additionally, the Act establishes the Agency's responsibility for observing, collating, collecting, processing, and disseminating all meteorological data and information both internally and externally; coordinating research activities among staff; and publishing scientific papers in various branches of meteorology to support sustainable socioeconomic activities in Nigeria.

## **1.2 Statement of Problem**

Disasters in whatever form be it man-made or natural has claimed many lives all over the world. Popular among these disasters are: Earth quakes, landslides, earth tremor, infernos,

hurricanes etc. Nigeria is not an exception to the occurrence to some of these disasters. In different parts of the country especially during the raining season, cases of severe floods, earth tremor are always recorded. During the dry season, occurrence of severe infernos is always taking place. This always occurs in market places. These occurrences put together has claimed innocent lives, destroyed many properties worth millions of naira and has also rendered many lives redundant. In the wake of all these anomalies, the Federal Government has invested lots of money into the purchase of artificial intelligence applications such as Geographical Information Systems, Remote Sensing systems, and remotely sensed geospatial data from satellites, etc, to reduce to the barest minimum, the occurrence of disasters in the country, yet these disasters still occurs in the country. It is in this regard that this study deems it fit to investigate the influence of Perceived Ease of Use and Usefulness of Artificial Intelligence Systems on Disaster Communication Practices among Employees of Disaster-Prevention Agencies in Nigeria.

### **1.3 Aims and Objectives**

The major aim of this study is to ascertain the influence of perceived ease of use and usefulness of artificial intelligence applications on disaster communication practices in disaster-prevention agencies in Nigeria.

#### **The objectives are:**

1. Ascertain the level of disaster communication practices among employees in disaster-prevention agencies in Nigeria.
2. Determine various communication practices among employees in disaster-prevention agencies in Nigeria.

3. Ascertain the level of usefulness of artificial intelligence applications existing in disaster-prevention agencies in Nigeria.
4. Ascertain the influence of perceived ease of use artificial intelligence applications on disaster communication practices among employees in disaster-prevention agencies in Nigeria.
5. Determine the influence of usefulness of artificial intelligence applications on disaster communication practices among employees' disaster-prevention agencies in Nigeria.
6. Determine the combined influence of perceived ease of use and usefulness of artificial intelligence applications on disaster communication practices among employees in disaster-prevention agencies in Nigeria.

#### **1.4 Research Questions**

1. What is the level of disaster communication practices among employees in disaster-prevention agencies in Nigeria?
2. What are the various communication practices among employees in disaster-prevention agencies in Nigeria?
3. What is the level of usefulness of artificial intelligence applications existing in disaster-prevention agencies in Nigeria?

#### **1.5 Research Hypotheses**

The following research hypotheses will be tested on a 0.05 level of significance in a null hypotheses form.

Ho1: Perceived Ease of Use of artificial intelligence applications will not significantly influence disaster communication practices of employees in disaster-prevention agencies in Nigeria.

Ho2: Usefulness of artificial intelligence applications will not significantly influence disaster communication practices of employees in disaster-prevention agencies in Nigeria.

Ho3: Joint influence of perceived ease of use and usefulness of artificial intelligence applications will not significantly influence disaster communication practices of employees in disaster-prevention agencies in Nigeria.

### **1.6 Significance of the Study**

All over the world, the occurrence of disasters emanate from two perspectives- man-made and natural disasters. Regardless of the form disaster that occurs, it is imperative for disaster prevention agencies to understand how to not only prevent these disasters from occurring but also to detect the likelihood of these disasters occurring and preventing them from happening.

The Federal Government of Nigeria has invested a whole lot on the prevention of disasters in Nigeria. Some of these disasters are: Floods, earth tremor, Infernos etc. Despite heavy investments of funds in preventing these disasters, they still persist in occurring. One wonders why this is still so, therefore this study will go a long way in revealing why disasters in whatever form still happens the way it is still happening and why it still occurs. This study will enable the Federal Government understand fundamental issues going on in disaster prevention agencies in Nigeria as regards use of artificial intelligence applications, in terms of formulating policies that will better aid ease of use of artificial intelligence

application preventing disasters in the country. Finally, this study will add to the repository of knowledge of Lead City University, Ibadan.

### **1.7 Scope of the Study**

This study is centered on perceived ease of use and usefulness of artificial intelligence applications in disaster prevention agencies in Nigeria. These agencies are: Nigerian Meteorological Agency (NIMET) and National Emergency Management Agency of Nigeria (NEMA). These agencies are established to rapidly respond to occurrence of disasters in any part of the country and they are also responsible to prevent the occurrence of disasters in any part of the country. However, employees working in technical units of these disaster prevention agencies in Nigeria will actually serve as respondents to this study.

### **1.8 Limitation of this Study**

One of the major limitation that hampered the success of this study is associated with the fact that many of the respondents were reluctant in filling the questionnaire designed to collect data for this study. Not until they were pacified and deeply persuaded that they decided to fill the questionnaire.

### **1.9 Operational Definitions of terms**

**Artificial Intelligence Application Usage:** encompasses perceived ease of use of artificial intelligence and perceived usefulness of artificial intelligence in disaster prevention agencies in Nigeria

**Artificial Intelligence:** machines demonstrating human intelligence

**Risk Communication:** exchange of information between those in disaster prone areas and experts

**Perceived Ease of use of Artificial Intelligence:** "the degree to which a person believes that using a particular system would be free of effort."

**Perceived Usefulness of Artificial Intelligence:** "the degree to which there is a believe that using an Artificial Intelligence system would enhance job performance."

**Disaster communication:** Communication during and immediately after a disaster situation which is an important component of response and recovery, that connects affected people, families, and communities with first respondents, support systems, and other family members.

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## Endnotes

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## **Chapter Two**

### **Review of Related Literature**

This chapter is an assessment of relevant literature to this research. It contains;

- 2.1 Conceptual Studies
- 2.2 Theoretical Framework
- 2.3 Review of Empirical Studies
- 2.4 Conceptual Model
- 2.5 Gap in Literature.

#### **Concept of Disaster Communication Practices**

Disaster is defined as 'a potentially traumatic event that is shared by a large number of people, has an acute onset, and is time-limited'. 1. A crisis (or disaster) is a significant disruption of society's functioning that results in widespread human, material, or environmental losses that exceed the affected society's ability to cope solely on its own resources. 2. Disasters can be natural (earthquakes, hurricanes, volcanoes, and outbreaks of the Ebola hemorrhagic virus), technological (oil spills), or man-made (terrorism and armed conflicts) and can have 'physical, social, psychosocial, socioeconomic, and political consequences. 3. Typically, a disaster is conceptualized in three distinct phases, which

encompass all events preceding, during, and following a crisis. 4. Disaster actors frequently express optimism about social media's potential to improve disaster communication. 5. Social media platforms have a high capacity for capacity, dependability, and interactivity, all of which may be advantageous for disaster communication. 6. Throughout the disaster lifecycle, social media channels and tools are critical and serve a variety of purposes. 10. One of their functions is to listen, as social media can provide a voice for those who would not otherwise have one. By doing so, social media platforms provide insight into people's behaviors and reactions in the aftermath of a disaster. 7. However, it should be noted that social media's listening function is essentially a passive collection of information. Another function of social media is to monitor a situation, which is critical when it comes to broadening people's reaction to events and better managing their behaviors by learning what they are thinking and doing about the event 8. If there are rumours about the dissemination of messages on social media, and even about their credibility, such situations are easily and quickly dealt with by well-informed people. Thus, disaster information generated and shared by residents of affected areas may include not only primary sources of information, such as eyewitness accounts or other personal observations, but also links<sup>12</sup>. Generally, shared information in these instances is accurate 6. Prior research on the use of social media during crises demonstrates how people use them, as well as how to extract and analyze useful disaster-related social media data 7. Additional research demonstrates that such social media applications can be used for a variety of different types of disasters and stages of the disaster lifecycle. Hurricanes, floods, earthquakes, and tsunamis are just some of the natural disasters covered by social media networks. Additionally, numerous studies on disaster recovery operations and techniques have been

conducted. Through a few studies, man-made disasters have also been the subject of research. 8.

Globally, major crises and disasters pose a grave threat to societies. The impact of disasters has increased significantly over the last three decades, and new risks are constantly being identified 9. Furthermore, "it appears as though not only the nature of major risks is changing, but also the context in which they manifest..." Specifically, systemic risks, i.e. "risks that affect the systems upon which society depends, such as health, transportation, the environment, and telecommunications." Crises are becoming more difficult to manage as a result of institutional fragmentation, increased interdependence and interconnections, and increased interdependence and interconnections. 9. In response to these challenges, a number of countries have implemented "all-hazards approaches," which take a broader view of risk, focusing on the connections between a variety of hazards and risks rather than on their isolation<sup>10</sup>. Additionally, the trend is toward a "whole of government" or "whole of society" approach to addressing these issues, which means that a diverse range of stakeholders are involved in risk management efforts. 11. Such approaches have enormous potential because they enable the mobilization of substantial resources and a diverse range of expertise to address risk management collectively. They are, however, associated with significant challenges that must be overcome. For instance, the more stakeholders involved in risk management, the greater the requirement for communication and information sharing. Sharing information in complex bureaucracies is always accompanied by barriers, which, unless addressed, can have a detrimental effect on the ability to manage risk 19. The current article discusses communication and information sharing in multi-stakeholder disaster risk management systems. According to the UNISDR, disaster risk management is

"the systematic process of utilizing administrative directives, organizations, and operational skills and capacities to implement strategies, policies, and enhanced coping capacities in order to mitigate the adverse effects of hazards and the possibility of disaster." 12. The Hyogo framework for action, which has been signed by 168 nations, is a critical driver of disaster risk management implementation. By signing this document, they commit to strengthening their capacity for identifying, assessing, and monitoring disaster risk<sup>13</sup>.

While disasters and crises are frequently used interchangeably, crises have been identified as organizational in nature, whereas disasters are community-based<sup>14</sup>. However, disasters can result in organizational crises when the public expresses concern not only about the disaster itself, but also about how well organizations handled the disaster<sup>13</sup>. In light of the connection between disasters and crises, this report includes research on social media usage during disasters and crises. Thus, we use the term disasters in general for all studies except those that focus exclusively on adverse events affecting organizations rather than communities. In these instances, the term "crisis" is used. Disaster communication encompasses information about disasters disseminated to the public by governments, emergency management organizations, and disaster responders, frequently via traditional and social media; as well as information about disasters created and shared by journalists and affected members of the public, frequently via word of mouth and social media. 14.

Disasters strike unexpectedly and vary in severity, posing a significant obstacle to effective information exchange and coordination. In disasters, lives are irreversibly shattered, livelihoods are destroyed, and people are displaced, with many unable to return to their pre-disaster normal lives – posing significant socio-psychological difficulties for the victims. The impact is not limited to the victims; victims' families, friends, first responders, and

caregivers all face extremely unpleasant situations. Due to the scale of these disasters, it has become clear that disaster communication and management strategies must be more coordinated and effective. Communication is a critical component of responding to natural and man-made disasters. Communication is critical during and after a disaster to aid in response and recovery efforts. Disaster victims communicate effectively with first responders, support systems, and other family members. As such, a community's resilience requires dependable and accessible communication and information systems.

Communication is critical during and immediately following a disaster situation, as it connects affected individuals, families, and communities with first responders, support systems, and other family members. Reliable and accessible communication and information systems are also critical to the resilience of a community<sup>15</sup>.

For a long time, communication technology has been recognized as critical to disaster management. Although communication technology is used in all four phases of disaster management, mitigation, preparedness, response, and recovery, the majority of application has historically occurred during the response and recovery phases. The new communication and information technologies developed over the last two decades enable greater integration of disparate communication systems. Interoperability between various communication systems, such as the internet, mobile phones, fax, e-mail, radio, and television, is becoming more functional. As a result, the opportunities for communication technologies to be used in disaster mitigation and prevention are expanding.

Scholars have defined disaster from a variety of perspectives throughout history. Defining disasters aids in the comprehension of their theory and methodology. During the early decades, disaster research was frequently limited to an implicit or partial examination of a

disaster phenomenon. Numerous glossaries exist for disaster-related terms and concepts. In attempting to compile key disaster-related terms, a study discovered that the term "disaster" has numerous definitions 16. Additionally, other studies asserted that, in the absence of an accurate and widely accepted definition, disaster research has become problematic 16. This issue arose as a result of the term's use in a variety of professional contexts. Other scholars emphasized the importance of standardizing definitions in order to provide a consistent structure for event reporting, data collection, and planning 17.

According to a study, 'a disaster is a product of its consequences.' He contended that 'as long as the walls survive the earthquake and the dam retains the water, there will be no disaster. Rather than that, he views disaster as the 'collapse of cultural safeguards.' 17.

According to the implied definition, a disaster is any incident that has significant negative and undesirable consequences. This may be the result of natural disasters (such as earthquakes, floods, and severe weather events), technological malfunctions, or incidents involving war and violence 18. Another study has begun to depart from this approach, separating disasters from other occurrences (such as civil unrest and wars)12.

Numerous scholars of disaster communication have also noted a significant increase in the demand for information about both affected and unaffected communities during disasters 13. Indeed, it would not be an exaggeration to say that there is a frenzy of information gathering from surviving victims, their family and friends, and interested stakeholders such as the various disaster response agencies. As a result, people frequently seek information from the mass media, individuals who appear to have authority, local government officials, or other community members as the primary source of information during the disaster response phase 17.

One could argue, however, about the validity of the information provided by community members. According to one study, community members lack the ability to aggregate and authenticate information, and thus informal communication cannot be automatically classified as formal. As a result of these information gaps, ongoing organization, monitoring of credibility, and additional verification are required to establish and disseminate reliable disaster communication for information seekers 16. Nonetheless, information seeking is likely to be beneficial when local individuals serve as sources of information rather than mass media. When information becomes fragmented, scarce, or even erroneous, affected communities are prone to merge and rely on others as reliable information sources. 18.

Communication trustworthiness as a determinant of disaster communication practices

Trust is not an easy concept to grasp. It encompasses a wide variety of concepts, including ethics, morals, emotions, values, and natural attitudes. 19. Additionally, trust is interdisciplinary in nature, encompassing fields such as philosophy, computer science, economics, and organizational behavior. As a result, there are numerous definitions of trust. Trust is defined as "one person's, group's, or firm's expectation of ethical behavior on the other person's, group's, or firm's part, that is, morally correct decisions and actions based on ethical principles of analysis on the other person's, group's, or firm's part in a joint endeavor or economic exchange." 42. This definition highlights the critical nature of trust in both personal and professional relationships. Additionally, a study notes that trust develops as a result of an expectation of fair behavior on the part of the other party in the partnership, as well as acceptance of the other party's rights and interests 20. Additionally, the definition includes the concept of a joint venture, implying that the partners share an understanding of

common business practices. Another implicit factor in the definition is the importance of ethical behavior. Ethics are defined as moral principles or standards of human behavior that shape our attitudes and behaviors. 21. Thus, any shift in ethics results in a shift in behavior, which influences trust. Finally, the definition implies that participants will work collaboratively to achieve the desired outcome. According to the study, acknowledging the reciprocity of the relationship ultimately results in the creation of goodwill 22. Thus, the definition encompasses universally applicable philosophical ethical principles that transcend disciplines and contexts.

Historically, trust has been examined through the lens of long-term relationships. This is because trust is defined as a historical phenomenon<sup>23</sup>. These studies indicate that trust develops gradually and accumulates over time. Time is a critical but frequently elusive component of the trust-building process in these temporary relationships. This is not to say that trust cannot exist in temporary groups. On the other hand, another study found that trust levels in initial relationships are frequently high 24. Additionally, a study argues that trust is critical in new and temporary organizations because it serves as a substitute for traditional control and coordination mechanisms 24. Rather than the rule, hierarchical management will be the exception. Rather than that, organizations of the future will be loose, changing networks based on trust for service brokerage and primary coordination mechanisms<sup>25</sup>.

The research on trust has been marked by a great deal of diversity in terms of disciplinary origins, methodologies, and definitions. Trust has been defined in a variety of ways, including as a general disposition toward others, a rational decision about cooperative behavior, an affect-based assessment of another person, and a characteristic of social

systems 26. The divergences in definitions and levels of analysis between scholars are less pronounced than they appear at first glance 27. These authors suggest, based on their analysis of the trust literature, that trust is a "psychological state comprised of the intention to accept vulnerability based on positive expectations about another's intentions or behavior" 28. In this section, we will examine the factors that contribute to managers' trust in their peers, specifically how subjective expectations about their peers' intentions and behaviors within the organization are generated. Thus, we will examine subjective assessments of peer trustworthiness rather than the trustor's actual risk-taking behavior as a result of these assessments<sup>29</sup>.

The majority of definitions of trust, including the one above, use the dyad as the fundamental unit of reference. Depending on the issue at hand, it can be aggregated into the perspective of the trustor on the one hand (i.e., proclivity to trust) and the trustee as a reference on the other hand (i.e., actual trustworthiness). Therefore, any statement about trust must involve at least two parties - whether they are individuals, groups, organizations, institutions, or entire societies. Finally, trust analysis must focus on how individuals (at a certain level of aggregation) trust and are trusted by other groups of individuals. This distinction between the trustor (who has certain expectations of another party and may or may not be willing to be vulnerable to the other party's actions) and the trustee (who is evaluated by the trustor) is critical for any analysis of the antecedents of trust 30.

The trustor's expectations about the trustee's trustworthiness can be derived from three basic sets of variables: (1) the trustor, (2) the trustee, and (3) their dyadic relationship (i.e., the interaction between both individuals through their relationship). The trustor and trustee effects can be further disaggregated in the intra-organizational context examined in this

paper into the two managers' individual characteristics as well as their specific connections to the organizational network 27.

The model's central premise is that the relative impact of the trustor and trustee on the former's expectations about the latter's trustworthiness is contingent on one critical aspect of their dyadic relationship: their communication frequency. This argument is consistent with a study finding that an individual's proclivity for trust should influence his or her level of trust in specific others, but primarily when the trustor is unfamiliar with them 28. Thus, when the trustor and trustee have little contact within the organization, the level of trust can be expected to be largely determined by the trustor's own characteristics and position within the organization. Similarly, the effect of the trustee's personal characteristics and organizational context would be expected to be smaller, as limited contact would obscure these characteristics to the trustee 29.

By contrast, with increased communication, the trustee's personal characteristics and context within the organization become more visible to the trustor and can be expected to have a greater influence on his/her assessment of the trustee's trustworthiness. In this case, the trustor is likely to rely more heavily on the greater amount of information directly available to him/her about the trustee's intentions and behavior throughout their relationship.

Thus, as their communication increases, we can anticipate a shift in the extent of influence away from the trustor and toward the trustee's individual characteristics and position within the organizational network 30.

Trustworthiness communication is an interactive process that influences, monitors, and guides members' actions and attitudes in their interactions with one another, ultimately

determining the level of trust between them 28. It is worth noting, however, that our conceptualization of trust goes beyond the concept of "swift trust," in which "individuals in temporary groups use category-driven information processing to form stereotypical impressions of others" 30. Thus, while the emphasis is on mechanisms for establishing trust in rapidly changing virtual environments, it is implied that communication channels between cooperating parties are open. In this regard, a study found that rapid trust cannot be maintained in the absence of subsequent communication. In effect, swift trust is a necessary but insufficient condition for trustworthiness communication. 32.

A sizable body of work has accumulated on the subject of public response to warnings. While this research tends to focus on a more narrow aspect of communication during a disaster, specifically on the characteristics of effective evacuation warnings, there are still insights to be gained. There is a much smaller body of work on more general recipient perspectives on communication during a disaster. Typically, the types of information recipients used, found useful, and trusted are not explored exhaustively in a single study, but rather findings must be pieced together from segments of numerous studies covering a range of threats, including terrorist threats, health crises, numerous natural hazards, water quality crises, and risks associated with chemical facilities 33. The findings regarding the most frequently used, useful, and trustworthy sources of information across these literatures are quite varied, owing to the diverse contexts, making generalization difficult. The following literature review attempts to synthesize what is known in order to better understand how our research triangulates with previously published work. To advance our collective knowledge in this field, several tentative hypotheses about information use during a disaster are offered<sup>34</sup>.

Trustworthiness of information is critical for effective disaster response actions in disaster communication. Affected individuals rely on information they believe is reliable. It is improbable that they will pay much attention to and act on information provided by someone in whom they lack trust in a situation that prevents the given information from being transformed into usable knowledge 32. Thus, trust and trust building are necessary preconditions for prompt decision-making in crisis situations<sup>35</sup>. Trust contributes to the information's perceived worthiness in the eyes of the affected people, as well as to the overall quality of the communication process and the efficiency of the information seeking process<sup>36</sup>.

Typically, humanitarian agencies (many of which are international in origin) play critical roles in disasters, not only by providing material and socio-psychological assistance to affected individuals, but also by providing critical specialized technical assistance to local teams engaged in disaster rescue efforts. However, as a result of their foreign origin and possibly a lack of familiarity with indigenous knowledge, customs, and sensitivities, humanitarian agencies frequently struggle to build trust within the affected community<sup>37</sup>. Developing trust takes time and requires a relationship with the targeted groups of people. However, disasters occur unexpectedly, and humanitarian agencies typically enter disaster-affected areas shortly after a disaster occurs, frequently with little knowledge of the target communities they are assisting. Thus, to close this knowledge gap, these humanitarian agencies should involve local support agencies, as they will be better equipped to identify appropriate local knowledge to expedite the trust-building process<sup>38</sup>.

Social media access as a predictor of disaster communication practices

The term "social media" refers to a broad range of technologies that enable the creation, dissemination, and sharing of content via online communities and virtual networks<sup>39</sup>. Social media is frequently referred to as Web 2.0 because it evolved from traditional online websites where website owners owned and controlled the content<sup>40</sup>. Additionally, social media focuses on the formation of online networks and communities<sup>41</sup>. These networks are built on the foundation of traditional offline relationships but are maintained through online connections<sup>42</sup>. Individual users' social networking sites are thus personalized based on their personal interests, but also on their connections, relationships, and networks<sup>63</sup>.

Although social media is a relatively new technology, it has quickly become an integral and pervasive part of modern communication<sup>43</sup>. Social media also plays a critical role in disaster communication. Scholars have examined the use of social media during a variety of natural disasters. Social media usage can be classified into two categories: passive dissemination of information (personal communication) and systematic use as an emergency management tool (30). According to one study, due to the speculative nature and infancy of these applications, the primary purpose of social media in disaster communication is to disseminate information 31. However, subsequent research has discovered that the maturity of these technologies and users' growing use of social media has resulted in an increase in innovative and proactive uses of social media by the public and government during natural disasters 34. A survey of social media use during the 2010/2011 Queensland and Victorian Floods in Australia discovered that Facebook was used to provide real-time information about the flood, assisting local authorities in providing relief efforts and mobilizing resources to assist flood-affected communities 35.

Thus, social media for disaster communication is a dynamic process that is shaped by context, users, and the nature of the crisis. While research has been conducted on the use of social media during various stages of a natural disaster, the majority of studies have been conducted in developed economies with more developed ICT infrastructure and more sophisticated citizen and government use of social media for disaster communication 35. This article adds to the growing body of literature by examining the novel ways in which social media was used in a developing Pacific island country during the strongest tropical cyclone ever recorded in the Southern Hemisphere: Tropical Cyclone Winston. 36.

With the proliferation of social networking sites and advancements in digital technologies, social media is proving to be an effective tool for disseminating information during natural disasters<sup>37</sup>. There is an increasing body of academic literature highlighting the critical role of social media and digital technologies during natural disasters. In the Pacific, documented how the introduction of mobile phone services in rural PNG villages, combined with increased internet access in urban areas and the development of websites that provide appropriate, timely information about natural disasters, has transformed the accessibility of information, knowledge, and communication for many people in PNG 37. A survey of social media usage during the 2010/2011 Queensland and Victorian Floods in Australia discovered that Facebook was used to provide real-time information about the flood, assisting local authorities in providing relief efforts and mobilizing resources to assist flood-affected communities. 68 exemplify the critical role that Facebook forums play in disseminating valuable information during and after disasters 38. From 2009 to 2012, there was an increase in the use of social media to disseminate information about the Ba floods. They demonstrate that some individuals used social media to spread information, raise

awareness, and solicit support. The growing use of digital technologies, including social media, facilitated the development of 'new modes of response and new forms of social capital'<sup>39</sup>.

Social media platforms are interactive digital tools that enable users to create, manipulate, and influence content. Social media platforms enable real-time, interactive communication and encourage dialogue and content exchange between message consumers and creators<sup>40</sup>. While many traditional media outlets (such as newspapers and television) continue to be critical channels for disaster communication, they primarily facilitate one-way information dissemination. Social media platforms can facilitate two-way communication and interaction between organizations, the general public, and individuals<sup>38</sup>.

Disaster communication is concerned with the dissemination of disaster information to the public by governments, emergency management organizations, and disaster responders, as well as the creation and dissemination of disaster information by journalists and the general public. Social media is increasingly used for disaster communication, in addition to more traditional modes of communication such as traditional media (e.g., newspaper, television, radio) and word-of-mouth (e.g., phone call, face-to-face, group). Social media platforms, which include a diverse array of web- and mobile-based tools, are defined by timely, interactive communication and user-generated content. <sup>39</sup>.

Globalization has been significantly impacted in recent decades by the proliferation of new media and communications. International travel and communication are now easier than ever. The proliferation of smartphones and social media has enabled the world to remain connected indefinitely and conveniently.

Human interaction and society have reached a new level of complexity and interconnectedness as a result of new media 40. Nevertheless, it casts doubt on the very existence of intercultural communication in the conventional sense. Previously, it took several weeks for a letter to cross the Atlantic Ocean. Today, it takes less than a second for a mobile device to relay a message. International travel is no longer as lonely as it once was, thanks to constant conversation and interaction with the rest of the world.

Teenagers and young adults are pursuing academic careers in a variety of cities around the world through study abroad programs. Sojourner is a term that is frequently used in study abroad literature to refer to an individual who is studying and living in a foreign country on a temporary basis, also known as a "study abroad" 41. Thousands of miles from home, sojourners retain access to the Internet and social media via international cellular data plans on smartphones. Within seconds, a tour of Vatican City can transform into an interactive online experience that can be shared with friends and family back home. This instant communication enables both senders and receivers to have a transparent and reassuring experience. As a result of this connection, the distances encountered while traveling abroad appear less intimidating. Friends and families are able to live vicariously through these young sojourners and vice versa due to access to new media.

While studying abroad is a valuable and enriching experience, it is all too easy to lose sight of it in the midst of new media distractions. Never before has a generation been more wired, yet so disconnected 41. Youth are viewed as a distinct group in need of protection from media, particularly their potentially negative influences, according to traditional media research. As early adopters of new digital technologies, youth are often at the cutting edge of new media interaction, influencing it through their actions. 42.

Due to the ease of electronic communication and cellular technology, the social media trend has exploded globally. Indeed, a study referred to this trend as a tool for businesses and individuals to communicate and collaborate 43. Sites of social media networks as 43: Web-based services that enable individuals to create a public or semi-public profile within a bounded system, articulate a list of other users with whom they share a connection, and view and traverse their list of connections as well as those made by others. Facebook, Twitter, Instagram, Pinterest, and blogs are all examples of social media network sites. Social networking sites enable users to communicate, make social networks available to them, and connect them to strangers and individuals they would not have met otherwise44. Similarly, social media is an informal platform that enables stakeholders to communicate in a way that is useful, informative, and consistent, according to Catherine Gluckstein, president of SumAll45. The advantage of social media tools is that they are inexpensive for leaders of organizations of any size46. "Social media refers to websites that enable the uploading and sharing of videos, documents, graphics/photos, and presentations." 47. Similarly, a study stated that "modern users rely on social media for nearly everything they previously relied on traditional websites, emails, and search engines for: communicating, shopping, researching, disseminating content, staying informed, and finding new friends and fans." 48. Social media tools are unmatched in their ability to foster relationships. There are over 50 social media networks with over ten million users. According to a Pew Research Center survey, 73% of online adults use social networking sites, with Facebook being the most popular. 49. Certain social media platforms have garnered popularity among various demographics. For instance, Facebook is extremely popular among a diverse range of demographic groups. Pinterest is extremely popular with females50. LinkedIn is widely

used by college graduates and households with a high income, while Twitter and Instagram are gaining popularity among young adults, urban dwellers, and non-Whites. According to the Pew Research Internet Project, the most frequently visited websites by users are Facebook, Twitter, and Instagram. Facebook users visit the site at least once per day 63% of the time, compared to 57% for Instagram and 46% for Twitter. 51. According to the Pew Research Center, Facebook is the most popular social networking site among online adults, with 71%, followed by LinkedIn (22%), Pinterest (21%), Twitter (18%), and Instagram (17%). Since the introduction of smartphones, 40% of cell phone users access a social networking site via their phone. 60% of Facebook users and 79% of Twitter users frequently recommend websites to other social media users. As a result, school districts that use Facebook and Twitter may be able to reach a broader audience if they also use other social media platforms. As a result, school districts that use Facebook and Twitter may be able to reach a larger audience if other social media users recommend their Facebook and Twitter pages. 52.

Despite the possibility of negative uses of social media for disaster response and risk reduction, there have already been some success stories in their use for disaster response and risk reduction. Social media platforms have been used to report on health issues such as cholera in Haiti and dengue fever in Thailand and Indonesia<sup>52</sup>. Following the March 2011 earthquake and tsunami in Japan, social media enabled public alerts, assisted in the location of missing people, and enabled mapping of various aspects of the emergency<sup>45</sup>. In January 2011, flash flooding in Queensland and Victoria, Australia, resulted in a sixfold increase in public access to emergency service Facebook pages, indicating a significant increase in interest and support<sup>86</sup>. Researchers have developed an online monitoring tool

for detecting sudden increases in the frequency of key words appearing on Twitter<sup>47</sup>. Additionally, researchers at the University of Indiana are monitoring Twitter rumours and abuses via a website called Truthy ([truthy.indiana.edu](http://truthy.indiana.edu)). Finally, the proliferation of crisis camps and their aggregations, crisis commons, has begun to promote a more systematic organization of social media for emergency response, utilizing wikis in some instances<sup>46</sup>. Occasionally, social media channel communication is the only mode of communication that survives the impact of disasters. As demonstrated by recent disasters worldwide, the use of social media platforms such as phone calls (typically mobile lines), Short Messaging Systems (SMS), Facebook, Twitter, and email has increased significantly during disasters. Individuals use these platforms to send and receive information about a variety of disaster-related topics. If the communication infrastructure remains intact, more traditional modes of communication, such as landline phones, may be used. For instance, the October 17, 2013 forest fires in New South Wales' Blue Mountains destroyed and damaged several hundred homes, trapping several hundred students in their Winmalee schools as the fires spread <sup>47</sup>. Numerous residents relied on their mobile phones to obtain timely and accurate information. The NSW Rural Fire Service used a smartphone application called 'Fires Near Me' during the crisis, which was downloaded nearly 200,000 times, and its Facebook page received over a million views per hour during the fire's peak. Its Twitter following increased from 20,000 to 37,000. In essence, these platforms aided in alerting people to rescue instructions and danger zones. Now, social media platforms enable networking and engagement with people during a disaster by disseminating pertinent information and collating posted information<sup>48</sup>. As a result, during disasters, social media platforms are flooded with information that spreads in an infinite number of directions and levels.

Disaster response personnel who are accustomed to receiving information in a one-directional (top-down) fashion are now confronted with massive amounts of information from the public, often before formal notifications are issued. Such circumstances necessitate that emergency response personnel become accustomed to a scenario in which information is shared in multiple directions.

In general, there are four distinct types of social media platforms that are utilized during disasters. To begin, the innovative user is the one who enhances and customizes social media to fit his or her unique circumstances. Second, the reactive user is the one who attempts to assist and respond to the affected population for the first time via social media. Thirdly, there is the responsive user – emergency responders who frequently use social media tools but intensify their use during disasters; and finally, there is the proactive user – emergency organizations that use social media tools to promote preparedness and leverage them during emergencies<sup>49</sup>.

Globally, the media is a significant player in society. It is widely recognized that the media is a powerful force for change and development in all spheres of life. It informs, educates, persuades, mobilizes, sparks debates, interprets, and entertains the public about current events<sup>50</sup>. The media is a critical stakeholder. Its involvement in disaster management has been deemed critical<sup>51</sup>.

Communication system reliability as a determinant of disaster communication practices

Natural disasters frequently destroy communication infrastructure and network systems such as transmission towers and cables, base stations, electricity distribution, transportation systems, and other facilities, resulting in a communication breakdown. 51.

Telecommunications equipment, such as transmission towers, is susceptible to natural disasters due to its structure and location. When these physical infrastructures are harmed, communication becomes a significant impediment in disaster-stricken areas. Due to their remote location, these structures are difficult to restore quickly. Communication is also harmed during disasters as a result of network overload and congestion; 'the majority of people attempt to communicate with one another, thereby exceeding the available communication bandwidth.' 52.

Reliability is critical for disaster management communication systems, as they may be deployed in remote regions that are not always accessible via conventional modes of communication, particularly in areas such as deep oceans and mountains. Occasionally, emergency rescue operations in remote locations, such as forest fires, avalanches, and landslides, rely heavily on the durability and reliability of the communication system, which must always be operational. As a result, it is generally recommended to use a wide area network with satellite signals. With the advent of satellite communication, the challenge of connecting remote and isolated areas has been alleviated. A large area can be covered in great detail using one or more satellites 52. For instance, Low Earth Orbit (LEO) satellites, which orbit the earth at a low altitude, can provide remote sensing capabilities. Satellite radio communication is also enabled by this technology, and it plays a critical role in disaster management. Satellite aerial photographs have the ability to reveal the severity of disaster zones in great detail. This technology is used not only for disaster management, but also for disaster forecasting. Meteorological departments use it to forecast potential natural disasters. 53. Wireless communication modules such as Motorola's VHF models,

Codan's NGT SRx, and the Portable Repeater system VHF can be used to establish communications in the disaster's immediate vicinity<sup>52</sup>.

Recent disaster research has shifted slightly away from a 'agent-centered' perspective and toward a focus on 'vulnerability.' According to one study, a disaster is an event that destabilizes the social system, causing normally functioning systems to fail to function, necessitating intervention to restore normalcy <sup>53</sup>. Disaster is viewed through this lens as a period of transition or change that entails vulnerability and necessitates new configurations of social interaction. Natural disasters are defined as occurrences that have a significant impact on the natural environment and socioeconomic system. Disasters are essentially the interface between a dangerous physical event and a vulnerable segment of the human population <sup>54</sup>. As such, disasters can be viewed as human vulnerability to environmental threats and extreme hazardous events.

The hazard-origins of disasters are now examined from a social perspective, primarily through the lens of vulnerability and resilience discourses. Scholars of disasters should begin by examining social systems, as they are the primary source of vulnerability <sup>54</sup>. Vulnerability manifests itself in disasters as flaws in social structures and systems <sup>55</sup>. emphasizes that 'neither an event nor a physical location or time period is relevant to disasters.' He asserts that the entire concept is social in nature – 'vulnerability is socially constructed through relationships within a social system, and disasters are predicated on the concept of social change'. <sup>55</sup>.

Vulnerability is defined in this context and for the purposes of this article as the diminished capacity (of an individual, group, or community) to anticipate, resist, cope with, and recover from the negative effects of natural or man-made hazards. While vulnerability is

frequently associated with poverty, it can also occur when 'people are isolated, insecure, and defenseless in the face of danger, shock, or stress'<sup>56</sup>. The degree of risk exposure varies according to one's social group, ethnic origin, gender or other identity, age, and other defining characteristics. Poverty can also play a role in defining vulnerability, as poor people's housing may be more vulnerable to disaster threats. Additionally, their awareness and capacity for disaster preparedness may be lacking, resulting in a slower response time in the event of a disaster<sup>37</sup>.

On the other hand, compensating for vulnerability necessitates deliberate efforts to increase capacity. This could be accomplished by mitigating the hazard's negative impact where possible through increased disaster preparedness, prediction, and warning, as well as mitigation. These initiatives assist communities in developing the capacity to withstand and cope with hazards. Additionally, it assists in addressing the underlying causes of vulnerability, such as 'poverty, poor governance, discrimination, inequality, and insufficient access to resources and livelihoods'<sup>38</sup>.

Natural disasters frequently devastate communication infrastructure and network systems, such as transmission towers and cables, base stations, electricity supply, transportation systems, and other facilities, resulting in a communication breakdown. Telecommunications equipment, such as transmission towers, is susceptible to natural disasters due to its structure and location. When these physical infrastructures are damaged, communication becomes a significant impediment in disaster-stricken areas. Due to their remote location, these structures are difficult to restore quickly. Communication is also harmed during disasters as a result of network overload and congestion, as 'the majority of people attempt to communicate with one another, thereby exceeding the available

communication bandwidth<sup>49</sup>. Reliability is critical for disaster management communication systems, as they may be deployed in remote regions that are not always accessible via conventional modes of communication, particularly in areas such as deep oceans and mountains. Occasionally, emergency rescue operations in remote locations, such as forest fires, avalanches, and landslides, rely heavily on the durability and reliability of the communication system – it must always be operational. As a result, it is generally recommended to use a wide area network with satellite signals. With the advent of satellite communication, the challenge of connecting remote and isolated areas has been alleviated. A large area can be covered in great detail using one or more satellites. For instance, Low Earth Orbit (LEO) satellites, which orbit the earth at a low altitude, can provide remote sensing capabilities.

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The evolution of a communication system is contingent upon the existence of the individuals who benefit from it, namely the signal senders and receivers. These two share a common interest and communicate about it. These shared interests serve as the foundation for communication between such individuals as a sexual pair. Parents and their offspring, flock or group members who feed, roost, or breed together. It is less frequently recognized

that individuals who are typically regarded as having conflicting interests. For instance, prey and predator, sexual rivals, parasites and their hosts may all share a common interest, which may serve as the impetus for the evolution of a communication system between them 51. Warning coloration, warning calls, and other signals given by a prey species to a predator, as well as threat display between rivals, are all examples of signals exchanged between individuals who primarily compete for the same resource. When two rivals communicate, for instance through threats, the possibility exists that one of them will gain an advantage through cheating 52. Thus, one may give a signal to indicate that it is a very powerful and capable warrior when, in fact, it is a coward and a weakling. If that were possible, there would be no reason for all individuals to abstain from cheating. If everyone cheats, the threat communication system will be worthless. Given that it is clear from the observation that the threat communication is effective, the system must include a reliability component that protects against cheating. Although the issue of cheating appears to be unique to communication between rivals, who frequently clash over their mutual interests, there is no reason why a smaller conflict between otherwise cooperating individuals would not benefit from cheating. A male may attempt to deceive a potential female mate in order to increase his chances of obtaining additional or better females<sup>52</sup>. An offspring may demand more than his fair share of care, food, and so forth from his parents, to the point where a conflict between parents and offsprings may arise. Similarly, a group of territorial birds may have a mix of shared and conflicting interests<sup>50</sup>. It's difficult to envision two individuals sharing common interests. That may or may not be in their best interests at some point or under certain circumstances. Thus, avoiding false information (cheating) is a

fundamental problem in the evolution of communication systems. The issue has been discussed in passing in relation to the evolution of sexually selected characters 53.

Social capital is a factor in determining how disasters are communicated.

Social capital is the web of relationships that connects people who live and work in societies, enabling them to function and evolve. Social capital is frequently defined in the field of social science as the norms and networks that enable people to act collectively 54.

Social capital refers to the characteristics of social organizations, such as norms, networks, and trust, that facilitate action and cooperation for the common good 55. Social capital is a simple concept that refers to an individual's family, friends, and acquaintances as critical assets that can be relied on during times of crisis 56. It is believed that those who have a diverse network of social networks and civic associations are better equipped to confront poverty and vulnerability, resolve conflicts, and seize new opportunities 56.

According to the OECD, social capital is defined as networks of shared norms, values, and understandings that foster cooperation within and between groups. Networks can be thought of as physical connections between groups or individuals, such as friends, family networks, or former coworker networks. It proposes three types of social capital connections: first, bonds formed by individuals based on a shared identity ("people like us"), such as family members, close friends, and individuals who share our ethnicity and culture. Second, it establishes connections that extend beyond a shared sense of identity, such as those with distant friends, coworkers, and associates, and thirdly, it establishes connections with individuals or groups further up or lower down the social ladder 55.

Thus, social capital implies some form of social empowerment that kicks in during and after a disaster. Social capital research has been used to better understand how vulnerable

populations employ available resources to meet pressing needs during a disaster<sup>56</sup>. There is evidence that decentralized decision-making through social networks, based on trust and reciprocal normative behavior, has increased the effectiveness of disaster response initiatives <sup>56</sup>. According to studies, communities with a higher concentration of human, physical, and social capital appear to be better prepared to deal with and manage flood events. Physical capital refers to tangible assets such as disaster search and rescue equipment, information technology capabilities, and financial resources that can be used to assist vulnerable communities <sup>57</sup>. Human capital, on the other hand, refers to the quality of manpower, which includes their level of skills, education, and health.

In disaster situations, trust is a critical component of social capital dynamics. When critical disaster information emerges from personal sources and is brought to the collective attention of groups of people<sup>58</sup>, trust is required. Thus, this requirement emphasizes the importance of social capital rooted in the personal relationships of an affected community in fostering trust within that community. <sup>57</sup>. The social capital of communities affected by disasters can contribute to the promotion of trust and community participation in communication. The characteristics of social networks, as defined by social capital, are associated with increased trust, voluntary participation, and cooperation among group members for their mutual benefit. <sup>58</sup>.

The concept of social capital can provide insight into how communities respond to disasters. To complement the conventional economic view of the importance of tools and physical capital, some researchers have argued for the importance of human capital; that is, how educated, trained, and healthy individuals contribute to effective economic growth. Recent years have seen a resurgence of interest in the concept of social capital; a term that refers to

the norms and networks that enable collective action 58. Social capital has been applied to numerous collective action problems, including family issues, schooling and education, work and organizations, democracy and governance, and development issues. To my knowledge, the concept has never been applied to disaster response, a classic instance of collaborative action for mutual benefit. 59.

The concept has numerous and varied intellectual roots<sup>60</sup>. At this point, social capital theory is somewhat fragmented in terms of the emphasis placed on it by various theorists. There is widespread agreement that social capital is a collection of resources embedded in social networks and social structure that can be mobilized by actors. There are disagreements regarding what should be included in this concept. To begin, some focus exclusively on social networks, while others, such as Bourdieu, emphasize group members' production of "cultural capital." A second issue, related to the first, concerns the proper measurement of social capital. There are now measures of physical capital, but none are without significant conceptual complications. A third point to consider is the dependent variable selection. For instance, his treatment of social capital is connected to his belief in the importance of civic engagement in fostering good government and his perception of a historic decline in civic engagement. Other studies concentrate on issues of social status and job search <sup>61</sup>.

The purpose of this article is not to criticize the concept, but to apply it to disaster response at the community level. Obviously, social capital will vary between and within societies. These distinctions must be explored in order to determine whether the concept is useful on a more general level.

However, the theoretical concepts will be derived from 61 in this instance. His discussion of social capital occurs within the context of a broader social theory that identifies the central elements of social life's historic transformation, most notably the decline of "primordial" institutions as the primary unit of social organization and their replacement by purposefully constructed organizations<sup>62</sup>.

Social capital is a term that refers to the facets of social structure that are valuable to social actors as resources that can be mobilized to advance their interests. As with human capital, social capital is not inherent in the actors. Rather than that, it is situated in the interpersonal relationships and personnel networks that exist between and among social actors. Social capital manifests itself in a variety of ways that all share two characteristics: Social capital is a component of social structure, and actors can use it as a resource to accomplish their objectives. As such, the concept can be used to account for the variance in outcomes associated with individual efforts<sup>62</sup>. It is a social resource that provides assets for individual action. As such, the concept's value lies in its ability to account for the diverse outcomes of individual efforts and the ways in which resources can be combined with other resources to account for the diverse outcomes of social systems<sup>63</sup>.

According to the study, physical capital is created by altering materials to create tools that facilitate production; human capital is created by altering individuals to impart skills and capabilities; and social capital is created when the relationships between individuals alter in ways that facilitate action <sup>62</sup>. Physical capital is entirely palpable and manifests itself in observable forms. Human capital is intangible because it is embedded in abilities and knowledge. However, social capital is even less tangible because it is embedded in interpersonal relationships.

Six distinct types of social capital have been identified in a study: obligations and expectations, informational potential, norms and effective sanctions, authority relationships, appropriable social organizations, and intentional organizations. 63. Responsibilities and Expectations: Any social system is heavily reliant on reciprocal actions and rates participants' obligations and expectations. Certain elements, in particular, are critical for this type of social capital: the environment's trustworthiness, which anticipates that the obligations will be repaid, and the actual magnitude of the obligations. Differences in social structures regarding the extent of outstanding obligations arise for a variety of reasons: trustworthiness, actual needs for assistance, the existence of other sources of assistance, the degree of affluence, and cultural differences in the tendency to lend and seek assistance. To have value in social capital, there must be trust that the resources will be available when needed. Additionally, the extent to which a system's outstanding obligations are a measure of its interconnectedness, as members are obligated to one another. Additionally, this connectivity increases the resources available to each member.

Information Potential: Information is critical because it serves as a foundation for action. One method of obtaining information is through the use of social relationships that have been established for other purposes. Individuals can increase their knowledge without having to seek it out directly.

Norms and Sanctions That Work: Norms reinforce and reward specific behaviors. Norms that encourage self-interest to be subordinated to the needs of the community are a particularly potent form of social capital. It facilitates some actions while restricting others. Within groups formed to accomplish specific goals, a leader is frequently chosen and given the authority to make decisions and speak on behalf of the group. The leader gains access

to a vast network of social capital through this transfer, which amplifies the social capital of individual members. In certain circumstances, a charismatic figure may be vested with leadership. In any case, grassroots organizations and political action groups are a source of social capital.

**Appropriate Social Organization:** Social organizations are typically formed for a specific purpose, and once that purpose is accomplished, the organization's goals may be redefined. Thus, an organization built for one purpose can be repurposed for another - sometimes for immediate gain, and sometimes for longer-term transformation.

**Intentional Organizations:** Developing social organization requires investment in structuring obligations and expectations, accountability, authority, norms, and sanctions. By establishing that, it advances not only the interests of those who invest, but also establishes a public good that benefits those who do not invest directly.

Social capital is the web of relationships that connects people who live and work in societies, enabling them to function and evolve. Social capital is frequently defined in the field of social science as the norms and networks that enable people to act collectively 114. According to 115, social capital refers to the characteristics of social organizations, such as norms, networks, and trust, that facilitate action and cooperation for the common good. Social capital is a simple concept that refers to an individual's family, friends, and acquaintances as critical assets that can be relied on during times of crisis 65. It is believed that those who have a diverse network of social networks and civic associations are better equipped to confront poverty and vulnerability, resolve conflicts, and seize new opportunities. 66.

According to the OECD, social capital is defined as networks of shared norms, values, and understandings that foster cooperation within and between groups. Networks can be thought of as physical connections between groups or individuals, such as friends, family networks, or former coworker networks. It proposes three types of social capital connections: first, bonds – the connections that individuals form based on a logic of shared identity ("people like us"), such as family members, close friends, and individuals who share our ethnicity and culture. Secondly, bridges – the connections that extend beyond a shared sense of identity, such as distant friends, coworkers, and associates – and thirdly, linkages – the connections to people or groups higher or lower on the social ladder<sup>67</sup>.

Thus, social capital implies some form of social empowerment that kicks in during and after a disaster. Social capital research has been used to better understand how vulnerable populations employ available resources to meet pressing needs during a disaster<sup>68</sup>. There is evidence that decentralized decision-making through social networks, based on trust and reciprocal normative behavior, has increased the effectiveness of disaster response initiatives<sup>69</sup>. According to studies, communities with a higher concentration of human, physical, and social capital appear to be better prepared to deal with and manage flood events<sup>70</sup>. Physical capital refers to tangible assets such as disaster search and rescue equipment, information technology capabilities, and financial resources used to assist vulnerable communities <sup>71</sup>. Human capital, on the other hand, refers to the quality of manpower, which includes their level of skills, education, and health.

In disaster situations, trust is a critical component of social capital dynamics. When critical disaster information emerges from personal sources and is brought to the collective attention of groups of people<sup>65</sup>, trust is required. Thus, this requirement emphasizes the

importance of social capital rooted in an affected community's personal relationships in fostering trust<sup>66</sup>. Social capital in disaster-affected communities can aid in promoting trust and community involvement in communication. This position is consistent with who asserts that the characteristics of social networks, as defined by social capital, are positively associated with the formation of trust, voluntary participation, and cooperation among group members for the common good <sup>68</sup>.

Social capitals are the inherent resources in social relationships that enable collective action. Trust, norms, and networks of association are all forms of social capital that represent any group that meets consistently for a common purpose <sup>69</sup>. Reciprocity is a norm in a culture with a high level of social capital, as it promotes bargaining, compromise, and pluralistic politics. Another tenet is the belief in citizens' equality, which promotes the formation of cross-cutting groups.

Individuals can develop unique social relationships such as friendships, norms, beliefs, and respect through interaction with others in this social network. For each individual in the system, the accumulation of these relationships can be viewed as a form of public wealth. Resource creation is a continuous process of dynamic interactions, with a strong emphasis on social interactions for information exchange, collaboration, and spontaneous interaction. Social capital can be classified into three distinct dimensions: structural (the overall pattern of connections between actors), relational (the type of personal relationship that people develop with one another over time), and cognitive (those resources that enable parties to share representations, interpretations, and systems of meaning) <sup>70</sup>. The structural dimension is concerned with the network's overall properties and refers to the overall pattern of connections among individuals, which indicates who and how people seek social

resources. From a structural perspective, there is a widespread belief that social capital benefits from the presence or absence of ties between actors, as well as the increased efficiency available for information dissemination. The relational dimension is concerned with the characteristics of interpersonal relationships. Among these are trust and trustworthiness, reciprocity and sanction norms, obligations and expectations, and identity and identification<sup>120</sup>. The third cluster of attributes is referred to as the cognitive dimension, and it refers to the organization's shared language, codes, and narratives. These language symbols can be used in electronic networks to assist individuals in sharing their knowledge and mental schema, removing barriers to communication, and reaching a consensus. Among the cognitive dimension's most critical facets are shared vision and shared language<sup>71</sup>.

#### Culture Beliefs as a factor in the practice of disaster communication

Understanding cultural dynamics and sensitivities contributes to the development of social resilience in the face of disasters. <sup>72</sup>. While vital infrastructure has become more resilient to calamities as a result of disasters, human behavior during disasters is frequently more difficult to control, even more so in situations where people continue to occupy and settle in hazardous regions. Thus, it is critical to understand the sociocultural worldviews and behaviors of individuals involved in disaster management. In reality, cultivating a resilient culture may help avert unnecessary victims and losses. Thus, culture should be viewed as a resource pool rather than as a hindrance<sup>73</sup>. Aspects of culture serve as reservoirs of resources and assets that can be used to mitigate the effects of disasters. Individuals are endowed with a cultural mosaic of 'knowledge, beliefs, values, norms, techniques, and artifacts,' which enables them to engage in and manage their physical, natural, and man-

made, and social environments,' respectively. Additionally, cultures incorporate certain skills, such as problem-solving approaches, that have been demonstrated to be beneficial for survival in a particular environment<sup>74</sup>.

Cultural beliefs about disasters and how to cope with them are frequently culturally defined. For instance, in comparison to other natural hazards, aspects of risk perception and disaster response behaviors in volcanic eruptions appear to be more closely linked to cultural beliefs<sup>75</sup>. In the majority of cases, such beliefs contradict the scientific and technical reasoning advanced by authorities<sup>76</sup>. Oftentimes, communities are more receptive to community-generated knowledge that is based on cultural rationality that has developed over time<sup>77</sup>. As a result, communities frequently disregard the occurrence of actual disasters. Without a complete understanding of this scenario, authorities prefer to concentrate on scientific and institutional approaches to disaster management, frequently disregarding public sentiment<sup>130</sup>. Numerous disaster scholars take a contrary position to this approach. They argue that authorities should consider cultural values in order to foster trust and mitigate outrage in the aftermath of a disaster<sup>78</sup>. To exemplify the discussion's points, a study of community-based disaster communication and trust building in the Mt. Merapi volcanic region on the Indonesian island of Java revealed several interesting findings. She discovered that the majority of people who live on the ridges of Mt. Merapi are of Javanese ethnic origin and speak the Javanese language. They observe Javanese culture and traditions, as do local community radio stations, which broadcast culturally significant local content <sup>76</sup>. However, studies have discovered that these cultural beliefs have shaped a fearlessness, resulting in a distorted perception of volcanic risks and a frequent refusal to heed official evacuation warnings <sup>77</sup>. Despite the detrimental effects on

risk perception, they argue that the Javanese culture appears to have a positive relationship with disaster communication trust. Using the local Javanese language for disaster communication was effective during the 2010 Mt. Merapi eruption, as the affected communities understand the language<sup>78</sup>.

Apart from the language, Javanese beliefs about disasters play a significant role in disaster communication. It was stated that there is some discrepancy between local wisdom and the official disaster response, particularly with regards to evacuation instructions. Local residents have been reluctant to follow official evacuation instructions, as their knowledge of local volcanic mythologies suggests a different assessment. In terms of eruptions, certain precursors can be observed<sup>79</sup>. An eruption should be preceded by earthquakes, lightning, and abnormal animal behavior. Due to the absence of precursors, they assume that the volcano will remain dormant for the time being, implying that there is no immediate need to evacuate <sup>80</sup>. It's also worth noting that the communities living on the slopes of Mt. Merapi have developed a 'culture of embracing hazard,' by conceptualizing volcanic hazards as occurring for their own benefit <sup>128</sup>. Volcanic eruptions are not destructive to these communities. Rather than that, the volcanic outputs provide fertile soil for improved agriculture, resulting in improved livelihoods. As such, it is critical to understand the cultural rationality and wisdom of vulnerable communities when communicating information during disasters. For example, in the Mt. Merapi case, authorities stressed that the evacuation was necessary to give Mt. Merapi 'extra workspace' to restore its natural state. This method was more likely to succeed in convincing communities to evacuate because it was consistent with their cultural knowledge of living in harmony with nature <sup>77</sup>.

The critical role of culture in disaster response was highlighted particularly during the Indian Ocean Tsunami. When the Tsunami struck the coasts of south Asian countries in 2004, some communities with indigenous knowledge about Tsunamis survived relatively unscathed, while migrants and tourists who lacked local knowledge were severely impacted 126. The survival of some indigenous communities in comparison to migrants and tourists was largely contingent on the presence of "cultural" knowledge about the Tsunami. Individuals have varying perspectives on culture, and some argue that it is complex and difficult to define. For some, culture is simply a way of life that expresses people's meanings and values; for others, culture is a way of discovering new ways of doing things 78. Anthropologists view the world as a "cultural mosaic" of inherited values and traditional culture 79. Edward Taylor, a renowned anthropologist, defines culture as "a complex whole that includes knowledge, belief, art, morality, law, custom, and any other capabilities and habits acquired by man as a member of society." 80. Similarly, culture can be thought of as a toolkit comprised of symbols, stories, rituals, and worldviews that people can employ in a variety of situations. These elements of culture are passed down from generation to generation and serve as a guide for individuals attempting to survive in society 81. Several definitions of culture include a "group element." Culture is defined as "a pattern of shared fundamental assumptions (beliefs) that a group acquired while resolving its external adoption and internal integration problems, and that has worked well enough to be considered valid." 82. Due to the fact that cultural aspects are considered valid and aid groups in their survival, they are taught to new members as the proper way to perceive, think, and feel about those issues. 83. Similarly, culture is "about a group of people who share a set of values and beliefs that embody ideas and are passed down

through enculturation to group members." 84. Culture is the common denominator that determines whether an individual's actions are associated with a group or not. Due to the strong connection between "culture" and "group," neither can exist independently. After examining several definitions of culture, the following section evaluates the components of culture 85.

Throughout the mainstream literature on disaster risk reduction, it is frequently asserted that cultural factors are overlooked when planning and implementing disaster risk reduction strategies 86. Similarly, a study asserts that governments and aid agencies have largely ignored the role of cultural values and attitudes as impediments to or facilitators of progress in DRR activities 87. They take into account the behaviors of communities and individuals when confronted with disasters, as well as the underlying cultural aspects of them 88. Additionally, the case studies evaluate instances where government interventions failed because cultural elements of the community were overlooked.

Individuals' ideology, honed by culture, regarding what is right and wrong may result in the formation of a particular mindset or set of beliefs. As illustrated in the following example, these cultural beliefs play a significant role in DRR activities. Merapi volcano in Indonesia is one of the world's most active volcanoes. Despite the dangers posed by the volcano, the Jevanese community continues to live on its slopes due to their livelihood patterns and cultural beliefs. Community members who live near the volcano make annual offerings to the volcano in accordance with their traditions. According to a study, the majority of the community living near the area believes that the volcanic eruption's losses are under the control of divine forces 89. During the eruption, some communities refused to evacuate their villages until they received instructions from their "cultural leader" 90. This example

demonstrates the community's value judgment regarding obedience to their cultural leader's commands. The community's belief system is such that they believe following the cultural leader's instructions is "correct" rather than following scientific knowledge and government instructions. Additionally, the community's belief in the relationship between god and man is evident in the offerings and prayers made to the "gods" associated with the hazards. Additionally, this example demonstrates how cultural beliefs, as discussed in Section 91 above, influence the behaviors of communities or groups. The Javanese community living near Merapi believes that their village and the land on which they cultivate are also their ancestors 92. As a result, even in the face of disaster, people prefer to remain in their village and always wish to return soon to their ancestors.

Within cultural definitions, "knowledge" that is passed down from generation to generation was emphasized. The critical role of indigenous knowledge in disaster risk reduction was demonstrated during the December 2004 Indian Ocean Tsunami. It was clear that different communities and individuals reacted differently to the Tsunami disaster. Certain communities and individuals who possessed indigenous knowledge about the Tsunami were able to survive it. For example, the Moken community in Thailand identified signs of a Tsunami in their traditional stories as unusual behavior of animals, birds, and low tide. As a result, this community shifted its focus away from the sea and toward protective areas 92. On the other hand, the majority of other communities, migrants, and tourists who lack embedded historical knowledge about Tsunamis failed to recognize Tsunami signs and thus did not evacuate the danger zone. Additionally, when they saw the low tide created, some of the communities in Sri Lanka that lack such historical knowledge about the Tsunami moved towards the sea rather than away from it. However, the author argues that a lack of

historical knowledge cannot be attributed solely to its non-existence<sup>93</sup>. This could also be due to a lack of historical knowledge transfer and/or a refusal to accept or disregard historical knowledge on the grounds that it is not valid or conforms to the community's current state of the art. Nonetheless, relying exclusively on indigenous knowledge for DRR activities may increase people's vulnerability. For instance, certain aspects of traditional housing construction on the Philippine island have been overlooked <sup>95</sup>. Bamboo trees are used to construct traditional houses due to their abundance in the natural environment. However, these houses lack measures to withstand strong winds and thus collapse during the monsoon season.

There is also a strong correlation between the importance of material culture and disaster risk reduction. During disasters, some communities refused to evacuate their homes and other possessions, indicating a strong attachment to the material they possess. According to a study conducted following the 2006 Merapi volcano eruption, despite the danger posed by the volcano, some people, particularly men, returned to their farms and homes day and night to protect them from looters <sup>136</sup>. They determined that the probability of being a victim of theft was greater than the threat posed by the volcano. Additionally, some residents returned to their villages despite the danger of the hazard in order to protect their homes and possessions. <sup>96</sup>.

As evidenced by the literature, the community's culture and livelihood are inextricably linked <sup>97</sup>. In the majority of cases, post-disaster recovery activities that ignored the affected community's livelihood patterns posed a challenge. For example, following the 2004 Tsunami, the Sri Lankan government imposed a 100-meter buffer zone, prohibiting any development within this zone. While the buffer zone was implemented to increase the

safety of the community living in coastal areas, it had an adverse effect on their livelihood patterns and primary source of income. As a result, the community continued to live in and use the 100-meter buffer zone despite government restrictions. This prompted the government to revise its buffer zone policy and develop an appropriate policy that takes into account both the community's livelihood patterns and safety 98. Another example is the 1992 earthquake on Flores Island in Indonesia, which resulted in the relocation of some communities on Babi Island due to the possibility of being hit by a tsunami. Nangahure, the relocated area, was approximately 200m from the shoreline. However, the relocation did not take into account the community's social, cultural, and economic conditions 71. As was the case in Sri Lanka, the sea was an integral part of their lives, and as a result, their livelihood - fisheries - was severely impacted by the relocation. Additionally, post-disaster reconstruction activities overlook the traditional characteristics of the community's houses. For instance, early houses were constructed on poles to avoid being submerged during high tides. During high tides, fishermen used these poles to secure their boats close to their homes. However, following the relocation, houses were built without regard for the community's requirements. According to a study, after eight years in 2001, the majority of the community returned to their relocated village Nangahure, living near the shoreline and erecting their houses on poles, creating a situation similar to that of the 1992 earthquake. 72. Understanding cultural dynamics and sensitivities contributes to social resilience in the aftermath of disasters. While vital infrastructure has become more resilient to calamities as a result of disasters, human behavior during disasters is frequently more difficult to control, even more so in situations where people continue to occupy and settle in hazardous regions. Thus, it is critical to understand the sociocultural worldviews and behaviors of individuals

involved in disaster management. In reality, cultivating a resilient culture may help avert unnecessary victims and losses. Thus, culture should be viewed as a resource pool rather than as a hindrance 73. Aspects of culture serve as reservoirs of resources and assets that can be used to mitigate the effects of disasters. As 135, people are endowed with a cultural mosaic of 'knowledge, beliefs, values, norms, techniques, and artifacts,' which enables them to engage with and manage their physical, natural, and man-made, as well as social environment. Additionally, cultures incorporate certain skills, such as problem-solving approaches, that have been demonstrated to be beneficial for survival in a particular environment. Cultural beliefs about disasters and how to cope with them are frequently culturally defined. For instance, in comparison to other natural hazards, aspects of risk perception and disaster response behaviors in volcanic eruptions appear to be more closely linked to cultural beliefs 74. In the majority of cases, such beliefs contradict the scientific and technical reasoning advanced by authorities 75. Oftentimes, communities are more receptive to community-generated knowledge that is based on cultural rationality that has developed over time 76. As a result, communities frequently disregard the occurrence of actual disasters. Not fully understanding this scenario, the authorities prefer to focus on scientific and institutional approaches to disaster management, often ignoring public sentiment 77.

Numerous disaster scholars take a contrary position to this approach. They argue that authorities should consider cultural values in order to foster trust and mitigate outrage following a disaster 78. To exemplify the points made during the discussion, a study of community-based disaster communication and trust building in the Mt. Merapi volcanic region on the Indonesian island of Java produced several intriguing findings. She

discovered that the majority of people who live on the ridges of Mt. Merapi are of Javanese ethnic origin and speak the Javanese language. They observe Javanese culture and traditions, as do local community radio stations, which broadcast culturally significant local programming 134. However, as documented in studies, these cultural beliefs have shaped a fearlessness, resulting in a distorted perception of volcanic risks and frequent refusal to heed official evacuation warnings 79. Despite the detrimental effects on risk perception, they argue that the Javanese culture appears to have a positive relationship with disaster communication trust. Using the local Javanese language for disaster communication was effective during the 2010 Mt. Merapi eruption, as the affected communities understand the language 80.

Apart from the language, Javanese beliefs about disasters play a significant role in disaster communication. It was stated that there is some discrepancy between local wisdom and the official disaster response, particularly with regards to evacuation instructions. Local residents have been reluctant to follow official evacuation instructions, as their indigenous knowledge of volcanic mythologies suggests a different assessment. Certain precursors to eruption can be observed. An eruption should be preceded by earthquakes, lightning, and abnormal animal behavior. Due to the absence of precursors, they assume that the volcano will not erupt anytime soon, implying that there is no immediate need to evacuate 81. It's also worth noting that communities living on the slopes of Mt. Merapi have developed a 'culture of embracing hazard,' by conceptualizing that volcanic hazards occur for their own benefit 82. Volcanic eruptions are not destructive to these communities. Rather than that, the volcanic outputs provide fertile soil for improved agriculture, resulting in improved livelihoods. As such, it is critical to understand the cultural rationality and wisdom of

vulnerable communities when communicating information during disasters. For example, in the Mt. Merapi case, authorities stressed that the evacuation was necessary to give Mt. Merapi 'extra workspace' to restore its natural state. This method was more likely to succeed in convincing communities to evacuate because it was consistent with their cultural knowledge of living in harmony with nature 82.

#### The Concept of Artificial Intelligence (AI) Systems' Perceived Ease of Use

The technology acceptance model predicts a user's intention to use a computer system based on their characteristics and perceptions. The user develops an attitude toward using the computer system based on perceived ease of use and perceived utility, which results in behavioral intention to use<sup>83</sup>. The TAM is critical to research because technology and software have advanced at a breakneck pace over the last few decades. Even though consumers are more accustomed to technology these days, it is still critical to predict their perception of a computer system in order to ensure that it is used. Users may occasionally lack a complete understanding of how a computer system should be used, resulting in a lower perceived ease of use and usefulness than they would have if they fully adapted and used the service 84. This indicates that the provider must emphasize the system's benefits; otherwise, the user may attempt to use the system as little as possible 148. The TAM has been used to predict consumer behavior in the existing literature, and it is stated that the TAM has been accepted in a variety of settings involving computer systems such as word processors, e-mail, voice-mail, and e-commerce. 85. However, existing literature highlights the importance of human interaction in the service process, with consumers who struggle with the service indicating a greater preference for human interaction during the service

process, highlighting the importance of high perceived ease of use and perceived usefulness.  
86.

The term "perceived ease of use" refers to the degree to which a system's user expects its use to be simple and effortless<sup>87</sup>. Contrary to what was previously stated, a study asserts that experienced computer users do not necessarily have more favorable attitudes toward, or intentions to use, novel types of technology systems<sup>81</sup>. However, discussed application and adaptation to a specific new technology rather than focusing on the application of previously existing systems<sup>82</sup>. On this basis, one could argue that a new type of technology can have a high or low perceived ease of use, regardless of the user's experience with other types of technology<sup>83</sup>. According to a study, age has an effect on users' perceived ease of use, but not on their perceived usefulness or intent to use. This means that while older users may have a lower perceived ease of use for a system, their perceived usefulness is unaffected by their age. Thus, providers must consider whether the developed system will be used by older adults and whether they will find it easy to use<sup>84</sup>. Another dimension of perceived ease of use is discussed by<sup>152</sup>, who asserts that perceived ease of use is related to the type of tasks for which the system was developed. They argue that developers frequently overlook the possibility that the system does not fit the type of assignments it is supposed to perform, and that simply changing the interface may not improve perceived ease of use. Examples of task/fit issues include the number of steps required to complete a task or the complexity of the steps, which makes system use inefficient<sup>85</sup>. Even as society continues to adapt to technology, some people still experience anxiety when using computer systems, which may have an effect on perceived ease of use<sup>86</sup>.

The term "perceived ease of use" refers to the degree to which an individual believes that using a particular system would be effortless<sup>87</sup>. The IS literature asserts that the greater the perceived ease of use of a system, the greater its perceived usefulness<sup>88</sup>. This is corroborated by the work of several additional researchers<sup>89</sup>. In comparison, another study discovered that perceived ease of use had no effect on perceived usefulness<sup>90</sup>. Additionally, a positive correlation between perceived ease of use and system usage was discovered, which was emphasized through the use of various contexts and technological applications<sup>91</sup>. However, other studies found that perceived ease of use had no effect on actual usage. <sup>92</sup>. Perceived ease of use (PEOU) is a measure of how easy a person believes a particular system is to use<sup>93</sup>. A user-centric approach emphasizes usability. Numerous prior studies have concluded that perceived ease of use has a significant impact on IT customer acceptance and usage behavior <sup>94</sup>. To examine the impact on users' mobile hotel booking loyalty intentions, we used perceived ease of use as a self-determining factor<sup>95</sup>. They discovered that perceived ease of use had a significant impact on users' loyalty intentions toward mobile hotel booking technology. Additionally, they discovered that compatibility significantly influenced perceived ease of use and comfort, and perceived ease of use significantly influenced loyalty and comfort.

The term "perceived ease of use" refers to the degree to which a user believes that utilizing a particular technology will be effortless and painless. <sup>96</sup>. Additionally, they discovered that perceived ease of use was emphasized more on the effortlessness of technology use with seamless relationships between the company's assets, employee capabilities, and technology infrastructure among Chinese textile and apparel company owners.

A study examined the mediating effect of perceived ease of use on the relationship between the quality of tax services and online tax in order to better understand self-employed taxpayers' efficient use of the online tax scheme in Nigeria 97. They discovered that there is a significant correlation between the quality of tax services and perceived ease of use, and that perceived ease of use is statistically positive for the online tax scheme. The advent of information technology has altered the way accounting transactions are recorded in the context of CAS. Professional accountants must understand how to use a computer and how to record accounting transactions using CAS

. It is recorded differently than in a manual accounting system, and it varies according to the type of CAS and the brand of accounting software. To some extent, system developers must understand how users perceive the system's ease of use. As a result, perceived ease of use will have an effect on the user's ability to utilize CAS. As a result, it is hypothesized that H1: There is a positive correlation between perceived ease of use and CAS use by accountants in MSEs in Xi'an, Shaan Xi, China. PLS-SEM methods are used to develop mobile technology. They hypothesized that stronger connections between perceived usefulness and behavioral intention, perceived ease of use and perceived usefulness, and perceived self-efficacy and perceived ease of use were developed.

Perceived ease of use refers to "the degree to which an individual believes that utilizing a particular system would be effortless," that is, that utilizing a particular technology would be free of physical and mental exertion 164. While the user may accept that a given innovation is beneficial, the user may discover that the innovation is difficult to use while using the mobile. For instance, on a mobile device, the object may be difficult to see. Ease of use refers to a user's perception of the level of effort required to use a technology or the

degree to which a user accepts that utilizing a particular innovation will be effortless and painless<sup>92</sup>. Without stress Interaction with artificial intelligence systems

The increasing availability of large amounts of data, the advancement of computing power, and the advancement of machine learning algorithms have resulted in significant advancements in a number of information technology (IT) capabilities, including computer vision, speech recognition, and natural language processing<sup>93</sup>. These capabilities, along with others, are collectively referred to as artificial intelligence (AI), as they enable information technology to perform tasks that arguably require intelligence<sup>168</sup>. IT providers have leveraged AI capabilities to enhance the performance of existing systems (e.g., decision support systems) and develop new applications (e.g. voice assistants). In keeping with previous research, we refer to the former as AI-enhanced systems and the latter as AI-based systems, which we collectively refer to as AI-enabled systems. According to recent market research, the growing adoption of AI-enabled systems has significant implications for society, organizations, and individuals in both private and professional settings<sup>94</sup>. Given that information systems (IS) research focuses on "how individuals, groups, organizations, and markets interact with information technology," interaction with AI-enabled systems is a critical area of study for the IS discipline <sup>56</sup>.

While public and academic interest in AI has recently increased, AI research has a long history. The term artificial intelligence was coined in the 1950s, and numerous AI-enabled systems have been developed since then. Because AI employs distinct approaches for achieving distinct capabilities, AI-enabled systems encompass a range of system types that are markedly distinct in their purpose and functionality (e.g. expert systems and autonomous cars). While there are reviews of specific types of AI-enabled systems, such as

recommender systems, and specific AI capabilities, such as natural language processing, knowledge about how the systems interact as a whole remains fragmented 57. A shared knowledge base, on the other hand, would facilitate future research projects on AI-enabled systems, which are likely to increase in popularity as a result of the renewed interest in AI. As a result, we believe it is worthwhile to examine what the information systems discipline has learned thus far about how humans interact with AI-enabled systems. Because the interaction between individuals and IT lays the groundwork for group and organizational interactions58.

AI is a multidisciplinary field of study that encompasses elements of philosophy, mathematics, economics, neuroscience, psychology, computer engineering, cybernetics, and linguistics59. 60 is one of the pioneers of artificial intelligence research. Turing raised the question of whether machines can think and proposed a scenario for testing this claim, which became known as the Turing test. The primary goal of early AI research was to develop a general human-like intelligence, also referred to as strong AI. Historically, the dominant strategy for developing strong AI has been symbolic reasoning. Symbolic reasoning is based on the idea that human experts can encode knowledge using symbols and that systems can solve problems by inferring rules from that knowledge62. While the first steps toward strong AI, such as the general problem solver by, demonstrated promise, progress quickly stalled, and it remains uncertain whether or not strong AI can be realized 63. Due to the failure of AI researchers to replicate human intelligence, they shifted their focus to solving more specific problems. This resulted in the development of expert (or knowledge-based) systems, which make use of symbolic reasoning to provide decision support in narrowly defined domains of expertise64. Another approach taken by AI

researchers is machine learning, which is defined as follows: "A computer program is said to learn from experience E with respect to some class of tasks T and performance measure P, if its performance at tasks in T, as measured by P, improves with experience E." Machine learning refers to a diverse set of algorithms and statistical techniques. These techniques are classified according to the function used to represent the acquired knowledge (e.g., decision trees, Bayesian networks, or artificial neural networks), which varies depending on the task at hand<sup>64</sup>. Additionally, machine learning techniques vary in terms of their underlying learning strategy (i.e. the way in which the program gains experience). Recent advances in machine learning have enabled significant advancements in a variety of fields of artificial intelligence research, including speech recognition and computer vision<sup>65</sup>.

The disparate approaches to problem solving in AI research raises the question of what constitutes an intelligent system. For example, the Turing test has been deemed insufficient to determine AI<sup>66</sup>. McCarthy and colleagues defined artificial intelligence for the first time in a workshop proposal: "For the purposes of this paper, the artificial intelligence problem is defined as the problem of teaching a machine to behave in ways that would be considered intelligent if a human did" <sup>67</sup>. Numerous similar definitions have been proposed over time, which fall into four categories <sup>68</sup>: AI as systems that think and act like humans, AI as systems that think rationally, and AI as systems that act rationally. These definitions provide context for the goals of AI research, but they do not definitively define what AI is. To our knowledge, there is no widely accepted definition of artificial intelligence—or, by extension, intelligent systems. Nevertheless, researchers have concluded that certain capabilities require intelligence. These include problem solving, knowledge

representation, reasoning, planning, and learning, as well as perceiving (including computer vision), acting (robotics), and communicating<sup>68</sup>. As a result, we refer to artificial intelligence-enabled systems as those that possess at least one of these capabilities. AI-enabled systems received considerable attention in information systems research during the 1980s, when expert systems were of interest<sup>69</sup>. Recently, recommender systems, the majority of which employ machine learning techniques, have become a hot topic in information systems research<sup>70</sup>. While previous reviews of the literature compiled information about specific types of AI-enabled systems.

Over the last three decades, the introduction and adoption of new technologies in learning and teaching have accelerated. When viewed through the current lens, it's easy to forget the debates that raged within our institutions over students' access to what are now considered primitive technologies. In a longitudinal study of accommodations for students with disabilities conducted in the United States of America between 1993 and 2005, the authors remind us of the controversy surrounding the use of calculators and spell check programs by students with disabilities and the general student body<sup>71</sup>. Text to speech, speech to text, zoom capability, predictive text, spell checkers, and search engines are just a few examples of assistive technologies that were initially developed to assist people with disabilities. Later, the application of these technological solutions was expanded, and they are now included as standard features in all personal computers, handheld devices, and wearable devices. These technologies now enhance all students' learning interactions globally, expanding the possibilities for teaching and designing educational experiences.

Additionally, artificial intelligence (AI) is now enhancing tools and instruments used on a daily basis in cities and on college campuses worldwide..

From search engines on the Internet to smartphone features and applications, to public transportation and home appliances. For instance, the complex set of algorithms and software that underpins the iPhone's Siri is a classic example of artificial intelligence solutions that have become integrated into everyday experiences<sup>72</sup>. Even though Apple's Siri is marketed as a low-complexity AI solution or a voice-controlled computer interface, it's critical to remember that it began as an artificial intelligence project funded by the Defense Advanced Research Projects Agency (DARPA) in the United States of America in 2001. This project was transformed into a company a year later, and Apple acquired it in 2007, when the application was integrated into the iPhone operating system. Google uses AI in its search engines and maps, and all new cars incorporate AI in various ways, from the engine to the brakes and navigation. Self-driving technology is already advanced, and several major companies, including Tesla, Volvo, Mercedes-Benz, and Google, have begun conducting trials on public roads in Australia in 2015. Surprisingly, a mining corporation is already utilizing self-driving technologies, having deployed self-driving trucks at two major operations in Western Australia<sup>73</sup>.

Personalized solutions are also closer than we imagined: at the end of 2015, 'new scientist' reported on Talkspace's and IBM's Watson's initiative to use artificial intelligence in psychotherapy <sup>74</sup>. This appears to be a significant step toward using AI to transform the complex endeavor of education. Indeed, Nick Bostrom, Director of the Future of Humanity Institute at Oxford University in the United Kingdom, has observed since 2006 that artificial intelligence has permeated everyday life: "A great deal of cutting-edge AI has filtered into general applications, frequently without being labeled AI, because once something becomes useful and common, it is no longer labeled AI." <sup>75</sup>. Once again, very

few people today identify Siri as a typical example of artificial intelligence. Given their growing importance in the global digital infrastructure, this also raises the question of how algorithms are conceptualized as we prepare for a variety of possible futures.

Students are now at the forefront of a vast array of possibilities and challenges in higher education for learning and teaching. Human-AI interaction and collaboration solutions are already available to assist individuals with disabilities. They have the potential to inspire educators to incorporate them into education in order to augment learners and teachers and create a more engaging process. Carl Mitcham defines a cyborg as "a cross breed of a human and a machine" in his *Encyclopedia of Science, Technology, and Ethics*. 76. The concept of cyborgs is not as far-fetched as we might believe, as the potential for combining human capabilities with new technologies is already being explored and developed at a breakneck pace. For instance, Hugh Herr, who directs the MIT Media Lab's Bio-mechatronics group and collaborates with the Harvard–MIT Division of Health Sciences and Technology, recently stated in an interview with 'new scientist' that "...disability will be eradicated by the end of this century, I'd argue." And that, I believe, is an extremely conservative statement. At the current rate of technological advancement, the majority of disability will be eliminated in 50 years." 77. This company develops cutting-edge prosthetics and exoskeletons, paving the way for bionic technology for people with and without disabilities. He notes that his research group created an interface that "makes use of biology to close the loop between human and machine." Consider a world in which our physicality does not deteriorate with age" 78. Complex computing systems powered by machine learning algorithms can assist people of all abilities and engage in human-like

processes and complex processing tasks that can be used in education and learning. This heralds the dawn of a new era for institutions of higher learning.

This type of human-machine interface has the potential to fundamentally alter how we learn, memorize, access, and create information. We are currently unable to answer the question of how long it will take to use this type of interface to enhance human memory and cognition. It may become a reality beyond the end of this century, as the MIT scholar suggests, or much sooner, given the rate of change in educational technologies since 2007, when the first iPhone was launched. Not only has the iPhone integrated previously unthinkable technologies into how we access and use information (such as fingerprint identification and the 'intelligent' Siri assistant), but it has also ushered in a significant cultural shift that has impacted our daily lives. In either case, if we shift the focus of 'cyborgs' away from science fiction and toward the idea of computer-augmented capacity for teachers and students alike, it is not implausible to believe that cyborgs or 'crossbreeds' of humans and machines will soon be a reality in teaching and research in universities in the near future<sup>79</sup>.

Artificial intelligence's impact on the global economy is already visible and has piqued the interest of numerous analysts. Google's largest investment in the European Union to date is the \$400 million acquisition of DeepMind technologies in 2014. DeepMind Technologies, rebranded as Google DeepMind, is an artificial intelligence startup based in London that specializes in machine learning and advanced algorithms. Notably, Google has also invested significantly in the German Research Centre for Artificial Intelligence (DFKI GmbH), which, according to their website, is "the world's largest research center in the field of artificial intelligence and its applications, in terms of employee count and external

funding." 80. Apple, Google, Microsoft, and Facebook are all engaged in artificial intelligence competition and are investing heavily in new applications and research. Google announced in December 2015 that its quantum computer, D-Wave 2X, will be used to perform complex AI operations, referred to collectively as optimization problems<sup>81</sup>. This new machine is 100 million times faster than any other computer on the market today, a significant leap forward for artificial intelligence, according to Google researchers: "We hope it helps researchers build more efficient and accurate models for everything from speech recognition to web search to protein folding." 81.

This surge in interest and investment in artificial intelligence will have a significant impact on universities in the near future. Financial pressures associated with the large number of students currently pursuing higher education as a result of the goal of democratization, as well as the international student market, will almost certainly serve as a compelling reason to seek out AI solutions. The academic workforce's 'outsourcing' in terms of academic staffing and tenured positions is now vulnerable to a massive takeover by intelligent machines<sup>82</sup>. The 'massification' of higher education and the political call to cut public funding for universities imply a genuine need for cost reduction. With research continuing to be the primary source of funding and prestige in international rankings, the MOOC hype exposed the alluring solution for many university administrators to cut costs through the elimination of expensive academic teaching staff. This trend is being aggressively pursued in Australian universities, with an increasing reliance on casual and short-term contracts; according to a study conducted by the L.H. Martin Institute, "there is an increasing trend in the number and percentage of academic staff on contingent appointments, and a declining trend in the percentage of academic staff with continuing appointments who teach and

conduct research" 88. Throughout the United Kingdom, we see similar initiatives, such as the University of Warwick's creation of a new department to employ all casual teaching staff in order to outsource teaching. This new department was established to operate in a manner "similar to another subsidiary used to pay cleaners and caterers, suitable for serving the University of Warwick and also selling teaching and assessment services to other institutions." 89.

As the examples on the previous page demonstrate, it is already possible to "crossbreed" the human brain and a machine, which will essentially require teachers to develop new dimensions, functions, and radically new pedagogies for a new context for learning and teaching. For example, brain-computer interfaces (BCIs), which captured the imagination of researchers worldwide, are making significant strides at the moment. Specialists in the field now provide feasible solutions for remotely controlling software via a brain-computer interface<sup>200</sup> by utilizing brain signals with various recording and analysis methods, as well as innovative technological approaches for new computing systems. BCIs are now capable of capturing and decoding brain activity, enabling individuals with motor function disabilities to communicate and control themselves<sup>90</sup>. According to the studies, "studies have demonstrated that healthy subjects and individuals with neurodegenerative disease alike can control brain-computer interfaces (BCIs) quickly and reliably." 91. Humanity and human possibilities are currently being redefined at an unprecedented rate by technology: technology is rapidly expanding the potential for using AI functions to augment our skills and abilities. As Andreas Schleicher put it, "educational innovation is not simply about incorporating more technology into more classrooms; it is also about rethinking

instructional approaches to ensure that students acquire the skills necessary to thrive in competitive global economies." 92.

### **Less error made when using AI systems**

Numerous obstacles, both theoretical and pragmatic, impede progress in the field of artificial intelligence (A.I.). One of these difficulties is related to integration and the construction of large-scale systems. According to a study, "while recent research has resulted in a large corpus of isolated component technologies, we continue to lack effective methods for integrating them." 93. According to a recent A.I. Magazine report on the annual RoboCup robot soccer competition, integration is "one of the most significant remaining challenges" in the field of robotics 94. Numerous sources substantiate these assertions. Recent attempts to build broader, more general-purpose AI systems demonstrate that the most successful solutions involve numerous researchers working in close collaboration in teams to integrate subsystems that each researcher built independently, forcing them into a unified system 205. It seems self-evident that a single coordinated mind, such as the one required for a robot capable of performing real-world tasks and conversing with humans in an efficient and appropriate manner, requires extensive integration of a diverse range of technologies from diverse fields of study such as linguistics, embodied communication, knowledge representation, vision, speech recognition, and planning. By and large, these fields of study have been "separated at birth," only to be reconnected on demand by those courageous enough to construct systems such as those mentioned above. The question is, as one study put it, "How can we develop software architectures that make large-scale [A.I.] software assembly easier?" 95. The task at hand goes beyond simply "gluing together" a number of the isolated solutions developed to date. One cannot glue

something together that the appropriate type of glue has not yet been invented. In a system composed of numerous components, where the whole is greater than the sum of its parts – as is the case with human and animal minds – the question of how the components work is as important as the composition of the various glues that hold them together.

The issue of architecture is relevant to more than just robot minds, where the obvious vision, hearing, planning, motor control, and balance all need to work well together; it is also relevant to disembodied systems that must reason using a variety of different methods – spatial, temporal, heuristic – and systems that integrate data from a variety of different real-world sources, such as seismic, population density, and road systems for the purpose of evacuation planning. 96.

We can divide the problem of A.I. integration into a practical and theoretical component, though the division will be imperfect. On the practical side, sophisticated artificial intelligence systems are being built (and rebuilt) without the critical knowledge transfer between systems. Apart from the theoretical issues, which we will discuss in a moment, integration barriers are created by a variety of practical issues, such as the use of disparate programming languages, disparate software operating assumptions, and a lack of computing power. These impediments to integration obstruct the development of larger, more capable A.I. systems. Interestingly, this runs counter to the fundamental tenet of science, which is incremental knowledge accumulation. The issue occurs in every artificial intelligence lab worldwide, where students implement runnable systems as part of their thesis, which are sufficiently manageable to support their work but lack documentation and other features necessary for successful handoff. -passed on to the next group of researchers. When other students and researchers in the lab attempt to use the work after the original

author leaves, they encounter an unusable piece of software. If they wish to build on previous work, they must do so using the thesis abstract and, if they are fortunate, a few published papers that are hopefully a little bit more polished. As anyone who has attempted to use poorly documented open-source software knows 97, an undocumented and uncommented software system is fairly useless.

Rather than attempting to build directly on previously implemented systems, researchers either re-implement (some of the) functionality of the former student's software from scratch or conduct their research in isolation from the functionality and context provided by the software. In the former case, the re-implemented system (a) will be inferior to the original (because it is not the current researcher's focus), (b) will be missing some critical features that were not conveyed in the write-up (due to deliberate or accidental omissions, errors, or both), (c) will have consumed far too much of the second researcher's valuable research time, or (d) will do all of the above. As a result of this, researchers are forced to constantly reinvent the wheel or work in increasing isolation. I maintain that neither of these states is desirable – both are detrimental to scientific progress, but they are particularly detrimental to A.I. research 98, as I will argue.

Continuous reimplementation can slow down research by a factor of ten or more.

3

The benefits of code sharing are evident in the annual RoboCup competition, where the winning team's planning algorithms are made available to the following year's competitors. According to those familiar with robot and planning development, the year-over-year improvement in performance of competing robots has been quite remarkable. If we did this for the entire field, and even added the (not prohibitively expensive) requirement that the

code be well documented and commented, the actual code developed by one party could be used directly and instantly by other researchers anywhere in the world, in whole or in part. The results would be spectacular. In light of this picture, it is clear that our field is stuck in reverse: such sharing is extremely rare, to the point of being practically nonexistent 99.

The fact that conducting research in isolation is extremely undesirable may not be as obvious as the preceding point, and thus I will now devote some additional space to this subject. We will discuss components and couplings throughout the discussion. Components are the functional elements of a mechanism; couplings describe the nature of the components' interactions. These interactions can take the form of a close bond. Although such couplings are rarely 1:1, a change in one component is closely reflected in the other component in a tight coupling. Additionally, couplings can have a complexity factor: A dense coupling allows for the sharing of a great deal of information between components. Complex information is occasionally shared between components in a rich coupling. It is impossible to predict the state of one component of a tightly coupled system without first knowing something about the state of the other components. This is even more true in systems that are tightly coupled at multiple levels of abstraction. The same is true for systems with a high degree of coupling. Complex systems with numerous components can be difficult to model. As anyone who develops computer networks is aware, simplifying the interactions between coupled nodes results in a more reliable, predictive network 87. When two simple elements interact, their interactions can be deduced relatively easily, even if they contain circularity. By increasing the number of elements within-to-interconnections to, say, 100, the entire system becomes exceedingly difficult to analyze and describe, even more so if the interconnections contain a mixture of connection types.

While it is possible that the prediction that we do not need to understand the human mind in order to create truly artificially intelligent machines is correct, it seems unlikely that at least some critical components of those machines will not directly replicate human mental tricks.

5

The cortex 88 is the part of the brain that truly distinguishes humans from other animals. The human cortex is involved in the regulation of the majority of higher-level cognitive functions, including perception and motor control. It is a highly modular structure, with cognitive functions distributed across a diverse array of cortical areas. The brain – and thus the human mind – derives its strength from a network of interconnected components, some with obvious functions and others with less obvious ones, but all of which play identifiable roles in the "theater of the mind." These components are coupled in a variety of ways, both loosely and tightly; the couplings are both simple and complex. Putting aside the question of the nature of mind for a moment, the theoretical issues revolve around the more fundamental question of whether a divide-and-conquer scientific methodology that has worked extremely well for some of the challenges presented by nature and the academic practices that have developed around it will work as well – or at all – for artificial intelligence. A system that is formed by a plethora of complex interactions between complex mechanisms cannot be adequately understood by studying the components in isolation.

Modern science advanced through an isolationist methodology – by dividing the world into "fields" and "topics" and studying each separately, developing methodologies and vocabularies in the process..

The method was dictated by necessity: it was simply the most rational course of action. In many ways, the strategy has been extremely successful. It is responsible for the development of physics, and by extension, chemistry, as well as a number of other fairly successful scientific theories 89. Logical reasoning and comparative experiments have worked in tandem to hone in on issues that were ripe for the picking. However, there is a significant disadvantage to the methodology, particularly when applied to complex phenomena. This approach's natural tendency is to compartmentalize each field, resulting in incompatible descriptions of the world. The tendency holds true both across fields and topics and within the same field. When a field develops what it believes to be a good model of a particular phenomenon, it is almost certain that it will be incompatible with theories of related phenomena, particularly if these were developed in other fields. When applied to the study of systems with highly coupled components, this can be a fatal flaw. 90.

The divide-and-conquer method is effective when all sub-problems are resolved. Artificial intelligence and ecosystems, for example, are not such issues. We must be cognizant of this aspect of the scientific method in our field or risk achieving little of the progress we seek. Again, we return to the essay's central theme: The solution is to resist the temptation to compartmentalize the problem of intelligence and instead attempt to study it in its entirety.

AI systems are simple to manage.

AI is a catch-all term that encompasses a variety of disciplines, including computer science, engineering, biology, psychology, mathematics, statistics, logic, philosophy, business, and linguistics. From Apple Siri to Amazon Go, and from self-driving cars to autonomous weapons, artificial intelligence encompasses a wide range of capabilities. In general, AI can be divided into two types: weak AI and strong AI. Weak AI, alternatively referred to as

narrow AI, excels at specific tasks. The majority of advancements in AI to date, such as Google Assistance and Alpha Go, can be classified as weak AI. However, researchers from diverse fields are competing to develop a robust AI (also known as human-level artificial general intelligence or artificial super intelligence) capable of performing multiple tasks proficiently. A strong AI is a contentious and divisive concept 68. Many transhumanists believe that a strong artificial intelligence can develop self-awareness and eventually reach the level of human intelligence. Once a powerful AI becomes a reality, an intelligence explosion will occur, and the technological singularity may become inevitable. Almost immediately following that 69, superintelligence may emerge. Superintelligence is loosely defined as "any intellect that significantly outperforms human cognitive performance in virtually all domains of interest." 70. In other words, a powerful AI would be capable of outperforming humans in nearly all cognitive tasks.

In 1959, a study coined the term "machine learning" and defined it as the study of how computers can learn without being explicitly programmed 71. Although this definition is somewhat ambiguous, it demonstrates an important characteristic of machine learning: it does not adhere to pre-programmed "rules." 72. In general, machine learning is an automated process that enables machines to analyze massive amounts of data, recognize patterns, and learn from the data in order to aid in prediction and decision making. "Reinforcement machine learning," as used in AlphaGo Zero, starts from scratch with only the rules of the game Go. It learned by adjusting actions in response to continuous feedback, and AlphaGo Zero achieved incredible results in a very short period of time (i.e. is probably the best Go "player" in the world at the moment) (i.e. a few days). It discovered Go moves that had never been seen before in the game's 3,000–4,000-year history. When

using large amounts of data for training, reinforcement machine learning can also overcome human biases that may exist in the data. The term "machine learning" refers to the automation of cognitive functions. 71. AlphaGo and self-driving cars are examples of the results of machine learning, particularly reinforcement learning. The disadvantage of machine learning at the moment is that its inner workings are a black box, making it difficult to comprehend and explain the reasoning process and to justify the recommendations. As a result, trusting these machines is a difficult proposition. Additionally, machine learning techniques based on big data may be susceptible to human biases inherent in the data 72. People tend to trust a system only when its reasoning process is transparent and understandable.

Robotics is the science that enables the development of machines, dubbed robots, capable of replicating human actions. Robots are classified according to their functions, with military robots, agricultural robots, medical robots, and domestic robots being the most common. They are not always human-like, as many are designed to perform repetitive and dangerous tasks rather than perform high-precision and creative activities. Many robots can walk and talk like humans and perform tasks such as lifting objects and carrying heavy loads, which helps them gain acceptance. Artificially intelligent robots are also expected to learn on their own, behave like humans, and even surpass humans in some ways. In this case, a robot is a physical function that has been automated and is guided by machine learning. 73.

The natural language processing capability of AI would benefit individuals who are unable to read and write, as well as those who are unable to use computers. According to reports, artificial intelligence in education in the United States will grow by 47.5 percent between

2017 and 2021. AI can assist teachers in releasing them from repetitive tasks such as grading, allowing them to focus on more professional work 75. Additionally, it is beneficial to expose students to this technology early in their education, as they are highly likely to work with AI in the future. Additionally, AI tools can assist in making global classrooms accessible to all students, including those who are unable to attend school. To remain current and progress in our ever-changing world, these applications must also support continuous life-long or never-ending learning. 76.

AI-based applications have the potential to significantly improve the health and quality of life of patients and seniors. AI's primary applications in health care include medication monitoring, chronic illness treatment, disease diagnosis, and surgical support. According to the National Bureau of Labor Statistics, the number of home health aides will increase by 38% over the next decade, while hospital stays will decrease as a result of personalized rehabilitation and in-home therapy 78. Between 2012 and 2017, funding for healthcare-related artificial intelligence reached \$2.14 billion. The medical field has seen numerous successes with AI-based applications, including mining social media to infer health risks, machine learning to predict high-risk patients, and robotics to assist with surgery 79. In the field of palliative care, studies indicate that only 20% of Americans spend their final days at home due to a shortage of palliative care professionals, despite the fact that 80% of Americans prefer to die at home. Additionally, AI can assist in predicting and identifying patients who require palliative care on an urgent basis. Algorithms that leverage AI have made headlines for their accuracy and speed in a variety of applications, from symptom diagnosis to clinical decision support.

Simple acclimatization to the AI system

Without a doubt, AI benefits society by enhancing human empathy and creativity and leveraging their emotional intelligence 82. For instance, Siri, the iPhone's assistant, is capable of recognizing user requests via voice message and responding appropriately. It has the potential to reduce uncertainty, decrease administrative time, and increase the efficiency of decision-making processes based on data evidence. In practice, AI applications vary due to the fact that it is programmed to use specific data to accomplish a specific task. Marketers who have access to this data can offer additional benefits to consumers in a more efficient manner. In recent years, the rate at which consumer data is being used in marketing has surpassed the pace set by academic scholars' analytics 83. As a result, unanticipated negative consequences may accompany initial programs and work against their intended positive outcomes. Additionally, the lack of transparency regarding algorithms has garnered public attention, resulting in the emergence of ethical concerns regarding the use of AI. Ethical concerns surround the emergence of machine learning, as it enables intelligence systems to access and learn from a large number of datasets, in order to derive their own rules, improve their behaviors, and develop cognitive competence..

The manner in which its performances elicited ethical reflections may result in a departure from established values and the introduction of new difficulties. For instance, system interruptions are common as a result of self-reflection. Because the capabilities of AI are initially dependent on human inputs, programmers' biases may exist; this may be problematic, as bias can also be replicated from previous events according to the algorithm. Thus, it is argued that when confronted with certain ethical dilemmas, intelligence systems require moral reasoning capabilities. 84.

Recent research on ethical AI, both from the data and information systems perspectives, has resulted in the mitigation of unjust bias. The goal of reinforcement learning (RL) is to avoid ethical dilemmas during the process of intelligent decision-making. It can learn from interruptions by analyzing data from humans or environments in order to avoid recurrent problems. Additionally, it is argued that developing ethical principles to guide the design of AI systems and rational algorithms is an effective way to ensure ethics. Nonetheless, this is not a simple task. Robbins' research indicates a lack of assistance from ethical standards or policy guidelines for regulating AI developers in order to strike a balance between the effective use of AI and societal concerns about ethics. Taddeo and Floridi emphasize that the formulation of ethical principles is context-dependent and subject-specific. 85.

Responsible AI is a governance framework for harnessing, deploying, evaluating, and monitoring artificial intelligence machines in order to create new opportunities for improved service provision. It is focused on developing and implementing ethical, transparent, and accountable artificial intelligence solutions that contribute to the preservation of individual trust and the minimization of privacy invasion. Responsible artificial intelligence prioritizes humans (e.g., end users) and complies with stakeholder expectations, applicable regulations, and laws. Prior to designing and implementing responsible AI, organizations must understand the practices that will contribute to the ethics and trust associated with its use. (1) Data governance; (2) Ethically designed solutions; (3) Human-centric surveillance/risk management; and (4) Training and education are the four practices of responsible AI. 86.

Responsible AI governance focuses on establishing transparency, trust, and the ability to explain. Transparency. It is critical for organizations to be transparent about their use of AI

by allowing stakeholders to fully understand how an AI application processes their data and makes specific decisions. According to a survey conducted by the Direct Marketing Association (DMA), 80% of consumers would be very or somewhat comfortable sharing personal data if they were aware of how digital data is shared and effectively used for marketing purposes. Capital One is transparent about their credit card criteria system by providing a computational decision with a detailed explanation to their customers when their credit card applications are approved or denied. Similarly, Alder Hey Children's Hospital, one of the largest children's hospitals in Europe, has developed Alder Play, a digital app that incorporates artificial intelligence. Alder Play has incorporated cognitive advances to provide its young patients with enjoyable and educational experiences. Young patients are able to activate their own avatars during their stay, earn rewards for successfully completing treatments, and gain access to additional guidelines and content. Alder Play provides healthcare professionals with access to the medical records of eligible patients for NHS treatment. Patients and their families would have access to their medical records via the internet. This could significantly improve clinical process transparency, thereby improving the quality of health care and increasing patient engagement. Establishing trust. Trusted AI is built on the foundation of high-quality data and user consent 87. AI combined with high-quality data has the potential to mitigate the generation of erroneous and inaccurate results. To ensure the quality and reliability of data, when developing AI algorithms and systems, it is necessary to identify the data sources, the data limitations, and data rules for sharpening data error detection. For instance, PwC partnered with H2O.ai to develop the ground-breaking bot GL.ai, which leverages AI algorithms to effectively track operational data and transactions and correct errors in order to maintain

accurate purchase histories and interactions with their business customers. What enables AI to function is its access to personal data. However, widespread access to personal data (e.g., consumer-generated content, online transactional data, and browsing and clicking data) has had negative consequences for individuals, businesses, and society. Consumer data availability raises serious concerns about privacy invasion, fraud, information leakage, and identity theft, while companies are unable to collect consumer data effectively due to consumer distrust. These trends have prompted regulators in a number of countries to place a premium on data protection and transparency regarding data use, as evidenced by the European Union's General Data Protection Regulation (GDPR) and Japan's Act on the Protection of Personal Information (APPI). These regulations seek to safeguard all individuals' rights to privacy and personal data and to empower individuals with control over their personal data. With the implementation of these regulations, it is critical for businesses to institutionalize the practice of obtaining consent statements or permission from users, reduce ambiguity surrounding data use, and communicate the logic behind automation to users effectively.

Justify your capability. By providing meaningful and personalized explanations for the outcomes of AI models, we can reduce uncertainty and increase user trust. To develop explainable artificial intelligence, IBM's proposed Supplier's Declaration of Conformity (SDoC) states that effective AI systems should be capable of properly interpreting algorithm outputs via examples and describing the testing methodology. PwC, for example, recently released its Responsible AI Toolkit to assist businesses in harnessing the power of AI responsibly and providing personalized advisory services. Similarly, Alder Hey Children's NHS Foundation Trust in Liverpool, United Kingdom, has pioneered the

intelligent application of digital techniques based on large sets of patient data. Alder Hey's AI systems, which are powered by IBM Watson cognitive analytics, enable healthcare professionals to interact with and provide personalized health services to children, thereby improving the quality and experience of care and ensuring the continued availability of sound health services. Patient experiences with AI-enabled personalized health services have been improved in terms of familiarization, distraction, and reward<sup>90</sup>. Specifically, prior to their arrival, patients can take 360-degree tours of hospital environments and watch introductory videos of blood tests and x-ray checks to familiarize themselves with hospital conditions and potential treatment experiences. Parents can communicate with a virtual assistant called Ask Oli to inquire about their children's health examinations and treatments. Questions are guaranteed to be answered immediately. Additionally, Alder Hey provides children with character-based stickers that are activated via augmented reality (AR).

**The Concept of Artificial Intelligence (AI) Systems' Perceived Utility:** Perceived usefulness is defined as the belief that a system will improve an individual's performance within an organization. While it is true that the TAM was initially developed to be applicable to organizational contexts, the model is now considered applicable to a wide variety of contexts. <sup>91</sup> Perceived usefulness can be defined in a consumer context as the consumer's belief that the system will improve the user's performance in comparison to the previous/alternative method. For instance, e-commerce may be faster, cheaper, and/or more efficient than visiting a physical store <sup>92</sup>. It may also apply to the purchasing process, delivery, or customer service, where technology may be perceived as enhancing or impairing the consumer's performance <sup>93</sup>. As with perceived ease of use, perceived

usefulness has been shown to be associated with anxiety 71. According to one study, an abuser's computer self-efficacy, or the user's assessment of his ability

There are several different extensions or modifications to the four research areas identified as requiring additional research on consumer acceptance of technology in the existing literature. These included the consumer's technical abilities, how technology relates to the consumer's needs and desires, how consumers can participate in co-creating technological systems, and how a technological system can be applied in a variety of contexts to generate profits 74. These findings are bolstered by a study that found that consumers' affinity for computers and perceived technical abilities have an effect on their willingness to use a particular system 75. Another study argues that the intention to use a technology system varies according to the stage of implementation 76. A similar study argues that one of the major flaws in the original TAM is that it relies on self-reported rather than actual usage of a system. This is critical, as self-reported use does not always reflect system acceptance or implementation. These models could be used in more complex studies in which the researcher examines the effect of personal characteristics on an individual's willingness to use a particular computer system, as well as how their acceptance of the computer system is influenced 72. While the study was conducted in an organizational setting, the findings suggest that users must be clearly instructed on how to use the system in a consumer setting 73. Additionally, these findings corroborate previous suggestions from, who argued that the provider must clearly communicate the system's benefits to the user in order for them to comprehend them.

acceptance of technology. However, if the objective is to examine users' perceptions of technology use and to forecast future intentions to use, external factors and personal characteristics are superfluous 77.

Perceived usefulness is defined here as "the extent to which an individual believes that implementing a particular system will improve his or her job performance." This is consistent with the dictionary definition of useful: "capable of being used advantageously." Individuals are generally rewarded for superior performance within an organizational context through raises, promotions, bonuses, and other incentives. 78. A system with a high perceived usability score, on the other hand, is one for which the user believes in the existence of a positive use-performance relationship. It is a critical determinant of technology usage and adoption 79. It is defined as a person's belief that utilizing a particular system will improve his or her job performance. 80. According to a previous study, perceived usefulness has a positive effect on actual usage when it comes to intranet technology 81.

In the field of electronic banking, the importance of perceived usefulness has been widely recognized 82. Usefulness is the subjective probability that a user's ability to complete a task will improve as a result of utilizing the technology. The technology acceptance model (TAM), which is based on social psychology theories such as the theory of reasoned action and the theory of planned behavior, has been validated as a powerful and sparse framework 83. Perceived usefulness, as defined by the TAM, is the degree to which an individual believes that utilizing a particular system would improve his or her job performance. Perceived usefulness refers to consumers' perceptions of the experience's outcome 84. The term "perceived usefulness" refers to an individual's belief that utilizing new technology

will enhance or improve her or his performance 85. Similarly, a study defined perceived usefulness as the degree to which an individual believes a particular system will help him or her perform better at work 86.

In Finland, a study used TAM and discovered that perceived usefulness was a predictor of actual behavior, encouraging users of twenty-first-century banking to adopt more innovative and user-friendly self-service technologies that give them greater autonomy in performing banking transactions, obtaining financial advice, and purchasing other financial products 87. However, a study found that perceived usefulness is contingent upon the banking services offered, which include checking bank balances, applying for loans, paying utility bills, transferring money abroad, and obtaining information on mutual funds 88. There is a wealth of evidence demonstrating the importance of perceived usefulness's effect on adaptation intention 89. Perceived utility is a critical factor in determining whether innovations are adopted. As a result, the higher the perceived utility of electronic banking services, the more likely it will be adopted<sup>90</sup>.

PEOU and PU are critical perceptions that influence IT adoption. In a subsequent study, the role of these beliefs was expanded upon, indicating that user intention to adopt new IT is influenced by both extrinsic and intrinsic motivations. According to Davis et al., "extrinsic motivation refers to engaging in an activity for the sake of achieving valued outcomes that are distinct from the activity." 91. By contrast, "intrinsic motivation" refers to the act of performing an activity for no apparent reason other than the act of performing it. Enjoyment is considered an intrinsic motivation, while PU is considered an extrinsic motivation, with the implication that extrinsic motivation should have a greater impact on IT adoption. The reason PU is such a significant antecedent of IT adoption is that in many

cases, a new IT is adopted primarily to facilitate the accomplishment of tasks that are not inherent in the use of the IT. PU is responsible for user evaluations of these aspects of a new IT 92. What they did assert was that PEOU would have an indirect effect on IT adoption via its effect on PU, as ease-of-use is critical in making a new IT more useful. However, the role of PEOU is likely to be more complicated than that. PEOU collects user feedback on the ease of use and learning. Thus, PEOU is concerned with user motivation, which is determined by an assessment of the intrinsic aspects of using the information technology, such as the interface and the process involved in using it. Arguably, because the extrinsic value of the IT (as captured by PU) and not its intrinsic value is frequently the reason for a new IT's adoption, this implies that PU, not PEOU, should have a direct impact on IT adoption. Much of the research on TAM appears to support this conclusion.

Nonetheless, PEOU should have an effect on IT adoption when the intrinsic characteristics of the IT, such as its interface clarity and navigational ease, contribute to the value of the end result for which the IT is being used. This should occur conceptually when the output of the IT is inextricably linked to the interface, at which point the PEOU of the IT should directly correlate to the value placed on IT outcomes. Whether the motivation to use the new technology is intrinsic or extrinsic is determined by the nature of the task for which the new technology is being used, not by the technology itself. Thus, email usage can be an intrinsic task, such as simply informing, or an extrinsic task, such as specifically improving organizational performance through improved communication.

These studies could be interpreted to support the study's central proposition. In the case of PC adoption or utilization, ease of use is both an intrinsic feature of the IT and a critical component of its extrinsic value. Additionally, for new users, ease of use of the IT (as

measured by PEOU) is a critical factor in enabling users to derive extrinsic value from the IT 91. Thus, a sizable proportion of the studies that did find a direct effect of PEOU on self-reported use may have focused on tasks intrinsic to the IT, as implied by the study's fundamental intrinsic-extrinsic proposition.

Cognitive usefulness is defined in the technology acceptance model as the extent to which an information system can assist users in improving their performance. Perceived usefulness refers to a customer's belief that the technology will improve their job efficiency 92. Therefore, if someone is impressed with a particular system and discovers that their job performance has improved to some extent, this indicates that the system has a greater influence on usefulness, and their attitude will shift in a positive direction 93. User satisfaction is strongly related to perceived usefulness. Piercy, a study that extends the TAM, examines the factors that influence the use of Radio Frequency Identification (RFID) in the context of libraries. Their study discovers that perceived usefulness, system value, and user attitude all have a positive effect on how RFID services are used.

**System Performance as a Determinant of AI Systems' Perceived Utility.** Since 2010, however, AI has resurged, owing largely to significant advancements in computer processing power and access to massive amounts of data<sup>94</sup>.

This renaissance of AI is the result of three (03) technological breakthroughs: (i) the introduction of a much more sophisticated class of algorithms; (ii) the introduction of low-cost graphics processors capable of performing large amounts of computation in a few milliseconds; and (iii) the availability of very large, properly annotated databases, which enables more sophisticated learning of intelligent systems<sup>95</sup>.

AI and its associated technologies (machine learning, deep learning, chatbots, neural networks, and virtual assistants, to name a few) are fundamentally reshaping businesses' and organizations' business and organizational processes<sup>96</sup>. Indeed, AI has already altered organizations' overall structure and relationship with their environment. AI has ushered in a new era of information management, posing both a challenge and an enormous opportunity for organizations; however, seizing this opportunity will require a shift in organizational culture, mentality, and skills<sup>97</sup>. For instance, IBM offers the Watson solution (named after former IBM manager Thomas Watson [1913-1994]), which is an artificial intelligence computer program designed to answer natural language questions in a variety of real-world settings (marketing, management, justice, and healthcare) <sup>98</sup>. One of its applications is the Watson Health service, which enables physicians to combine current medical data and patient data in order to personalize patient care, including the patient's advantages and disadvantages<sup>99</sup>. AI research advancements have made it an unavoidable topic of discussion in the current decade. AI has made significant progress since the 1960s, which was confirmed in the 2000s with the emergence of "Machine Learning" (automatic learning: machines 'learn' from datasets provided to them), the latest development of which is "Deep Learning" (which relies on neural networks) <sup>100</sup>. Indeed, deep layers of neural networks are trained using machine learning algorithms. Rather than modeling massive amounts of data (e.g., calculating all possible moves in a chess game or replacing images in videos), neural networks learn by digesting millions of test data (medical diagnostics and efficacy of new drugs, energy reserve estimation, and price forecasting) <sup>101</sup>. When combined with big data, these types of AI perform operations and actions that are faster and more relevant than human actions.

Numerous sectors and services are already or will soon be impacted by these technological innovations, including transportation with autonomous vehicles, health with disease detection programs (cancers and other diseases) via Machine Learning and Deep Learning, customer relationship management with the use of conversational agents, natural language processing, and automatic email processing by virtual robots, security with facial recognition and artificial vision technologies, and urban planning with smart cities. AI can be deployed across the organization's entire value chain, integrating virtually all aspects: research and development, maintenance, operation, sales and marketing, planning and production, demand forecasting, and services<sup>103</sup>.

Considered a critical growth factor, AI enables any organization to accomplish the following: (i) improve the efficiency of operations, maintenance, and supply chain operations; optimize and enhance the customer experience; enhance products and services (with new features); and streamline the item recommendation process (retail and other industries) (ii) enhance rapid and automatic response to changing market conditions, develop new business models, and optimize the relationship between supply and demand through improved forecasting and planning capabilities; (iii) detect and prevent fraud (in banking and other sectors), automate threat intelligence and information systems, automate IT functions (IT systems and processes), and optimize sales processes; (iv) diagnose and treat pathologies (Koh & Tan), anticipate disease and its evolution, promote personalized treatment recommendations, assist in decision-making by advising on diagnosis, prevent by anticipating epidemics and acting on pharmaceutical vigilance; and (v) automate quality assurance. 92. With these statistics, Tractica's data on market trends is unquestionable: AI is expected to generate nearly \$90 billion in profits by 2025, up from only \$7 billion in

2018. North America, Europe, and Asia-Pacific will continue to benefit the most from AI and its numerous technologies. 93. Indeed, by 2025, three areas of AI will be the most promising: (1) object detection, identification, and avoidance; (2) static image recognition, classification, and marking; and (3) medical patient data processing. Between 2016 and 2025, these sectors could generate a cumulative revenue of nearly twenty-one (21) billion euros. 93.

Artificial intelligence is set to increase business efficiency by providing business organizations with real-time insights into how their operations are performing. Adopting AI into existing technology will significantly increase business efficiency; for example, using humanoid office robots to learn office tasks and perform them more efficiently than human-based labor. The humanoid robots are equipped with real-time data analysis AI, which simplifies information retrieval. Additionally, the AI-enabled humanoid robots can be connected to other business systems, allowing management to better monitor and coordinate the activities of various departments than is possible with business intelligence dashboards. The use of deep learning and TensorFlow to streamline the hiring process by automating the process of reviewing job applicant information for those who apply via an organization's website, thereby assisting in the identification of qualified candidates. The time-saving deep learning AI application will assist organizations in easily locating and recruiting human resources, thereby increasing efficiency and minimizing downtime caused by a lack of skilled manpower 94.

Due to the growth of e-commerce, every business organization that has created a website or ventured into online sales values online customer communications management. Chatbots powered by artificial intelligence are being used to manage social media communication

and engage online customers. As a result, chatbots can save time and respond to customer queries more quickly than human-assisted customer service. Thus, chatbots are a relatively recent AI tool that can be used to increase organizational efficiency and provide organizations with a competitive edge in terms of customer service and response time 95.

Through personalized recommendations generated by the deep learning application, which can create a customer profile for all online buyers, deep learning AI applications are increasing the efficiency and speed of shopping. In other instances, businesses are leveraging AI software applications such as deep learning to augment investment options, thereby improving investment decisions and detecting potential fraud. The application of AI-powered software enables businesses to gain virtual assistance in managing a large number of customers, which is critical for today's business models. Chatbots keep businesses connected to the markets at all times, which helps keep customers informed of new product information 96.

Information is critical in today's organizational marketing; AI-enabled business intelligence systems can analyze market data and provide business insights into the most effective strategies for marketing goods and services, as well as which products are performing well in the market. Within a short period of time, AI software can easily analyze information and data points on the Web and provide the necessary feedback for the business to improve its processes 97.

Due to the high degree of global interconnectedness, many organizations have struggled to protect themselves against cybercriminals who take advantage of the vast number of possibilities and targets. Businesses can leverage new artificial intelligence to manage and protect their data and online e-commerce customers from the growing threat posed by

cybercriminals. Due to the computing power, data collection, storage, and interpretation capabilities of machine learning and AI, they can be used to tame cybercriminals in a proactive manner by identifying security risks and implementing mitigation strategies prior to any damage being done to customer or business data and systems. Machine learning techniques and ongoing AI retraining can be used to anticipate cybercriminals' thoughts. As a result, business organizations can use AI to enhance cybersecurity in a preventive and predictive manner. Numerous business organizations have fully developed digital models that are powered by systems that are easily hacked by cyber criminals, posing a risk to the organization's overall operations and customer trust. When human beings are in charge of system security, numerous loopholes and gaps are left due to human security analysts' human nature. Machine learning and artificial intelligence work indefinitely and without regard for time constraints, which eliminates all potential gaps for cybercriminals to exploit in order to commit cybercrimes such as fraud and information theft. Thus, the use of AI and machine learning can help to mitigate the overall threat posed by the skills gap, as well as the number of malware that can remain dormant in business systems for extended periods of time before being detected, thereby reducing the vulnerability of business systems<sup>95</sup>.

#### Job Support as a Determinant of AI Systems' Perceived Utility

Automation's threat to eliminate a large swath of jobs across the global economy is now well established. With the advancement of artificial intelligence (AI) systems, another wave of job displacement is almost certain. It's a distressing image. However, here's what we've been missing: Numerous new jobs will also be created — jobs that are diametrically opposed to those that exist today. We identified the emergence of entire categories of new, uniquely human jobs in Accenture PLC's global study of over 1,000 large companies that

are already using or testing AI and machine-learning systems. These roles are not intended to take the place of previous ones. They are novel, necessitating the acquisition of previously undeveloped skills and training. (Accenture's study, "How Businesses are Using IT to Reimagine Business Processes," will be published this summer.) More precisely, humans in these roles will complement cognitive technology's work by ensuring that it is both effective and responsible, as well as fair, transparent, and auditable.

Numerous widely quoted initial reports predicted that automation of jobs and tasks would eventually replace a significant portion of the human labor force. According to a widely quoted report, up to 47% of jobs in the United States of America could be automated in the next 10 to 20 years<sup>96</sup>. Using a similar methodology, a study estimated that this figure could be even higher in the EU, at up to 54% of jobs automated in the next 10 to 20 years.

According to one study, adding one robot per 1,000 workers reduces the employment-population ratio in the United States of America by 0.37 percent and wages by 0.25 to 0.5% on average. Using a similar approach, he models the impact of robotics on employment in six European countries, concluding that adding one robot for every 1,000 workers 'decreases employment by 0.16 to 0.20 percentage points'. As frightening as these predictions are, the majority of subsequent theoretical and empirical work suggests that the impact of AI-automated job losses may be significantly overstated. Recent theoretical refinements, for example, suggest that, depending on the elasticity of demand for the product in question, employment may actually increase as a result of automation. If demand is elastic ( $>1$ ), employment may increase. Consistent with these theoretical expectations are newer empirical studies that demonstrate: I while some jobs and sectors may be at risk of automation, the impact is heterogeneous, and many new jobs and tasks may be created in

other sectors; (ii) automation may affect tasks rather than jobs; (iv) the pace of innovation in AI is slowing; and (v) As a result of these considerations, we believe it is improbable that pessimistic scenarios of widespread job losses as a result of new technological innovations will materialize. Rather than that, the theoretical challenge is to explain how advancements in AI can coexist with stagnant wages and productivity - which is what we attempt to do in sections 3 and 4. For the time being, however, let us examine each of the empirical findings mentioned previously in greater detail. To begin, there are methodological concerns with forecasting future job losses as a result of automation. Their methodology has been criticized in the initial and widely quoted report. Thus, AI is likely to create a large number of new jobs or tasks, including some that do not currently exist. Empirical evidence suggests that this is already occurring. For instance, a study found that automation had resulted in no net job losses in Germany<sup>97</sup>. Similar estimates that automation will threaten jobs in the UK (around 30%), but concludes that the net effect of automation on jobs will be neutral as a result of new jobs created elsewhere in the economy<sup>98</sup>. These new jobs elsewhere in the economy are more likely to be created as a result of increased demand for products, which can occur as a result of new technological innovation creating new products that consumers want or by making existing products significantly cheaper, thereby stimulating production and, indirectly, labor demand. Thirdly, automation may have a greater direct impact on tasks than on jobs. According to a study, claims of mass unemployment as a result of automation or robotics are exaggerated because automation tends to alter the nature and content of jobs, such as the tasks that a job entails, rather than completely eliminate a job. Fourth, automation is unlikely to result in mass unemployment, as the rate of innovation may be slowing. There are concerns that ICT progress is slowing in fields directly relevant to

automation, such as artificial intelligence (AI), as a result of declining computer processing power (declines in Moore's Law) and the declining marginal cost-benefit ratio of acquiring large datasets for developing AI via deep learning 98. Automation is having a 'evolutionary' rather than a 'revolutionary' effect on jobs in the United States of America, gradually replacing workers in 'a minority of sectors' 99. Fifth, the spread of artificial intelligence technology is much slower than anticipated (and may even be slowing), limiting the impact of automation on jobs. As a result, the employment impact of automation is unlikely to be as severe as previously predicted (and may even be positive). At the end of the day, it may be an empirical issue for different countries, depending on the extent and size of elasticities between AI and labor, on demand elasticities, and on the extent to which AI can result in product innovations that stimulate demand growth. Stagnant demand may explain why we see advancements in AI but not significant job losses or wage and productivity growth.

#### Increased Productivity as a determinant of Perceived Usefulness of AI systems

Artificial intelligence (AI) is a term that refers to the use of computer and information technology to create machines that can mimic human cognitive abilities. Machines equipped with artificial intelligence are capable of learning and solving problems, and will play a significant role in research and manufacturing facilities. Artificial intelligence is still in its infancy, but it will eventually enable machines to acquire the learning and reasoning abilities that are unique to humans 99. Giving machines the ability to learn is accomplished through the use of algorithms that can deduce patterns and generate insights from the data they are presented with. Algorithms enable machines to make future decisions and predictions based on previously learned patterns and insights. Artificial intelligence in machines is a process that requires extensive programming to ensure the efficiency of each

action and possibility. Thus, artificial intelligence is a collection of machine learning techniques used to accomplish tasks that require human reasoning and intelligence. Visual perception and speech recognition are examples of human intelligence that artificial intelligence can possess. Technology applications in today's business world continue to improve decision-making and overall business operations efficiency. Business management and operations are living in a data-driven era, which is reshaping day-to-day business processes. Artificial intelligence aims to leverage the abundance of data available to promote business intelligence decision making by utilizing sophisticated algorithms to gain insight into future business processes, consumer behavior, and market trends; and to promote informed decision making, which provides businesses with a competitive edge over competitors.

According to a study, rather than viewing AI business systems as a substitute for human beings, they should be viewed as tools to assist humans.

AI is capable of analyzing large amounts of data more quickly than the human brain and can generate action plans based on possible insights, which can be used to improve organizational decision-making processes. In comparison to other business intelligence software, AI's ability to make decisions outperforms all other traditional data analysis software used by businesses.

Artificial intelligence is set to increase business efficiency by providing business organizations with real-time insights into how their operations are performing. Adopting AI into existing technology will significantly increase business efficiency; for example, using humanoid office robots to learn office tasks and perform them more efficiently than human-based labor. The humanoid robots are equipped with real-time data analysis AI,

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businesses connected to the markets at all times, which helps keep customers informed about new product information 98. Information is critical in today's organizational marketing; AI-enabled business intelligence systems can analyze market data and provide business insights into the most effective strategies for marketing goods and services, as well as which products are performing well in the market. Within a short period of time, AI software can easily analyze information and data points on the Web and provide the necessary feedback that can be implemented by the business to improve business processes 100.

Productivity and living standards have historically increased as a result of a continuous division of labor (specialization) and the automation of more tedious, arduous, and routine tasks. In agriculture, for example, a modern farmer purchases sophisticated machinery to industrialize the production of farm goods that are then sold through regional distribution centers, rather than plowing his or her own acre for self-consumption as centuries-old farmers did. Highly specialized labor at each level of such supply chains, combined with automated processes, enables the production of goods and services on time and to predefined quality and quantity standards. And agriculture was only the first sector to benefit from automation, owing to its dominance in terms of total employment even in advanced economies until the 1950s. With the invention of the steam mill and subsequent widespread electrification, manufacturing industries ranging from textiles to automobiles pushed the boundaries of productivity through a combination of automation and ever finer division of labor.

In contrast to contemporary fears, the wave of automation that occurred during the nineteenth and early twentieth centuries resulted in a rapid increase in demand for low- or

unskilled labor, raising concerns about the demeaning nature of technological change 101. As agricultural productivity growth resulted in a mass exodus of labor, unskilled laborers frequently found new employment opportunities in manufacturing or other sectors such as mining and construction that were flourishing as a result of automation. As the division of labor progressed, workers were required to focus on ever-narrower, highly repetitive tasks that needed to be completed quickly. This so-called Taylorist approach to work organization – dubbed by organizational specialist Frederick Taylor a "scientific management" approach to production – created significant strain among workers who lost their ability to identify with the end result of their work. As a result, social movements began to emerge in the 1960s to express demand for less demeaning work, improved working conditions, and faster wage growth. Simultaneously, this was the period of greatest productivity growth in advanced economies, lifting large segments of the population out of poverty and establishing a rapidly expanding middle class.

Income growth coincided with an increase in educational attainment. As (young) workers gained education, technological advancement shifted gears, laying the groundwork for the third industrial revolution, which was triggered by the introduction of computers 102. Following the 1970s, technological advancement became increasingly skill-biased, gradually increasing demand for intermediate- and high-skilled workers at the expense of those with only a primary education or less. Although the observed increase in unemployment was largely due to macroeconomic changes, work processes began to change, with manufacturing employment gradually declining in all major advanced economies as more sophisticated machines and robots – "automatically controlled, reprogrammable, multipurpose manipulator, programmable in three or more axes, and

capable of being fixed in place or mobile for use in industry" – became available. Simultaneously, the process of designing, implementing, and maintaining these robots and computers resulted in the emergence of an entirely new industry, albeit one with significantly fewer job opportunities than those lost to automation. Overall, existing research indicates that the employment effects of robots remained relatively limited or, depending on the methodology used, were even positive in aggregate<sup>103</sup>. The introduction of robots had a significant negative effect on employment only when the analysis was expanded to developing countries<sup>104</sup>.

As manufacturing employment declined, the service sector assumed the role of a jobs generator. Among other sectors, business services, transportation, and distribution (wholesale and retail) created new jobs tailored to the workforce's more educated and trained members. Since the 1990s, concerns about automation have been confined to a shrinking workforce in manufacturing, while attention has shifted to working conditions and opportunities in services. In particular, the advent of information and communication technologies (ICT) stimulated investment in new technologies, accelerating – temporarily – productivity growth and creating new job opportunities, albeit frequently under less favorable conditions than those experienced during the manufacturing employment boom.

Nonetheless, this third industrial revolution, fueled by information technology advancements and the introduction of robots, has generated significantly less economic benefit than the previous two waves of technological change. Indeed, a long-term examination of economic development in seven selected advanced economies reveals a deceleration in productivity growth, despite a brief acceleration in the 1990s. This is also reflected in comparable trends in GDP per capita (i.e., including the inactive population),

which demonstrate an extraordinary lack of accelerating improvements in living standards. This observation perplexed economists in the 1980s, when Robert Solow famously stated that "the computer age is visible everywhere except in the productivity statistics" 104. Apart from measurement issues arising from the digital nature of ICT innovations, this could be explained by the fact that advances in ICT have impacted only a few sectors (notably transportation and logistics, in addition to telecommunications), in comparison to previous, general-purpose technologies such as electricity 105.

**Task Accomplishment as a Predictor of AI Systems' Perceived Utility.** Alan Turing introduced the concept of artificial intelligence to the world in 1950. Numerous researches have been conducted since then to strengthen the AI. Scientists are attempting to create robots that are efficient in a variety of intelligence domains such as perception, reasoning, decision making, self-learning, natural language processing, and problem solving. While conducting this research, researchers have encountered a variety of problems and difficulties and are working to resolve them. Thus, numerous times, the research, problems, and future of AI are primarily discussed 105. Even the negative aspects of AI are discussed in order to avoid future complications, but there is little discussion of how to test whether so-called intelligent robots are truly intelligent. Alan Turing, the father of artificial intelligence, attempted to address this question by proposing the infamous 'Turing Test.' However, another well-known test known as the 'Chinese Room Test' demonstrated its inadequacy. The issue is that even the most intelligent-appearing actions, such as conversing and playing chess, are merely illusions created by sophisticated computer techniques or advanced mathematics. These are not based on true cognitive ability. Thus, with this theme as our focal point, we've attempted to investigate a few 'tasks' that, when

presented to a 'intelligent' machine, will demonstrate its level of intelligence. To formulate a task, we drew on a variety of intelligence domains. Using these tasks, this paper will demonstrate how to tell the difference between genuine intelligence and intelligence imitating intelligence. Completion of these tasks by any virtual machine will open up a plethora of new possibilities for AI applications, and these tasks may also serve as a guideline for future research techniques. Additionally, we attempted to justify the continued research and development of AI for the benefit of humanity. 106.

It is critical for the advancement of artificial intelligence that machines develop the ability to recognize objects. To validate these abilities and enable the robot to identify the object, it is necessary for him to 'learn' all of its characteristics, including its shape, size, volume, weight, material, material type, and intended use. This can be accomplished by requiring him to learn through all of his senses. To teach him about a red-colored plastic ball, for example, we must first provide him with its shape, color (vision), nature (touch), bouncing property (sound, vision), and, of course, its name. We can assign him the task of discovering all of the characteristics of any unknown object (having known about its general features). For instance, if we give him an idol to explore, he must be able to identify all of its details, such as whether it is an idol, what material it is made of (PoP, metal), its color, what the idol is made of (the design of a human, any animal, etc), the material's nature (hard, brittle), and its purpose. If the machine is capable of exploring all of these possibilities, we can conclude that it is capable of correctly identifying the object. Additionally, it must be capable of identifying the object when its view is partially obscured. Then and only then can we conclude that a robot is intelligent in terms of object recognition. 106.

Vermont is the first state to initiate a formal investigation into the opportunities and challenges associated with the development and use of artificial intelligence.

1 Despite being the first in the country, it is late to the process. Artificial intelligence development and use have accelerated in the state, to the point where it now impacts the lives of all Vermonters. While some experts predict that artificial intelligence will drive tremendous growth, others predict that its economic benefits will be unequal and that it will erode privacy and democracy. The Vermont Artificial Intelligence Task Force was tasked by the Vermont Legislature with determining how a small state can maximize the benefits of artificial intelligence while minimizing the negative consequences of its deployment. The Task Force spent considerable time learning about artificial intelligence, its development and use in Vermont, and listening to the public's views on how the state should respond to this technology. This report summarizes the Task Force's findings and recommendations. We are living in an era of rapid technological advancement, facilitated in part by the use of artificial intelligence. While the term "artificial intelligence" has been in widespread use since the mid-1950s, the first A.I. algorithm was developed and successfully applied to the game of checkers 107. In this case, a computer was programmed to react, predict future moves, and make decisions based on its opponents' decisions – effectively mimicking human intelligence and reasoning in order to win the game. Since then, the term has been loosely applied to a variety of techniques ranging from classical optimization and control theory to much more advanced self-learning and self-evolving techniques. Additionally, A.I. is frequently confounded and conflated with more conventional forms of automation (for example, airplane autopilots) and robotics. The Task Force considered numerous definitions of artificial intelligence drawn from a variety of

sources. Finally, the Task Force determined that while there is no perfect definition, it is critical that a common definition be used. Thus, the Task Force adapted the definition of "artificial intelligence"<sup>108</sup> from the European Union Glossary.

The Task Force concluded over the course of its existence that there is, in fact, a role for local and state action, particularly where national and international action is lacking. State competition for economic rewards becomes more competitive as a result of large-scale technological change, whereas inaction leaves states behind. States can take the lead in developing appropriate responses to technological change, which will eventually result in national policy and action. The following report makes a series of recommendations for policies and actions that are consistent with Vermont's limited authority to direct the development and use of artificial intelligence in the state. The Task Force concludes that Vermont can make a difference by maximizing the benefits of artificial intelligence and mitigating or adapting to its negative consequences.

Jobs are composed of a series of tasks. If some of these tasks are automated, job profiles may be altered by adding new tasks or modifying existing ones rather than by completely eliminating a job. The task description of an administrative assistant over time can demonstrate how similar jobs continue to perform tasks that have not been automated (yet) alongside new tasks that either did not exist previously or were performed by a different group of workers. Thus, whether or not jobs vanish depends on whether it remains profitable to group specific tasks into specific job profiles and hire workers specifically for these (new) jobs, which is more a question of demand for the specific products and services that these jobs are supposed to deliver than of skill supply to fill the jobs <sup>109</sup>.

Significantly, cross-country differences exist in the way jobs are designed and tasks are reorganized into jobs.

According to a study, tasks have distinct characteristics in terms of training, supervision, and production requirements, which are not always aligned. Depending on how much emphasis a company places on training, supervising, and aligning its employees' workflows, different tasks may be regrouped into jobs from one company to the next. This will be partially determined by the characteristics of the country in terms of education and training infrastructure, tax incentives, and social benefit systems 110. Thus, even companies operating in the same industry but in different countries may respond to institutional differences by setting up their internal work processes and job profiles very differently, as demonstrated by the differences in how Apple and Samsung externalize their supply chains. As a result, determining whether task automation will result in job loss is a technological as well as an institutional question that cannot be determined a priori by examining the automation process alone. Recent evidence appears to confirm the critical role of institutional factors in determining the outcome of occupational changes, as seemingly similar patterns of job polarization across countries can be influenced by a variety of factors 105.

Even when tasks can be automated, they may not be eliminated entirely. Rather than performing a specific task, an employee may be charged with ensuring that the machine performs the task properly and intervening in the event of an emergency or error 106. For example, the introduction of automatic pilots has not rendered air pilots obsolete. Even though a pilot flies a plane for an average of about seven minutes during an entire flight, having a human at the control panel is just as critical as ever for intervening in extreme

situations, sudden disruptions, or technical malfunctions not anticipated by the auto pilot (such as a simultaneous breakdown of both engines). Similarly, it may still be necessary for a worker to ensure that machines are properly parameterized and configured, particularly when orders change or a new production line needs to be established. Additionally, the amount of time spent on each individual task may vary: Doctors, for example, may spend less time analyzing symptoms and more time ensuring a patient's well-being and individual needs as a result of AI support for disease diagnosis. In either case, automation does not always imply that a task no longer requires human assistance. Rather than that, the question becomes whether bundling a set of tasks to a specific job remains profitable, as well as how quickly a worker can shift within the current job to perform slightly modified tasks or task sets. If this entails requiring new, costly skills, automation is likely to result in inequality within occupations rather than across them 107.

## **2.2 Theoretical Framework**

### **Technology Acceptance Model as model for Perceived Ease of Use and Usefulness:**

Since its inception in 1989 (Davis 1989; Davis et al. 1989), the technology acceptance model—TAM—has garnered considerable attention in the information technology community. Recent research indicates that this also holds true for e-commerce and the adoption of Internet technology 111. In essence, TAM asserts that prior use-related beliefs influence IT adoption. TAM identified two such beliefs: perceived utility (PU) and perceived ease of use (EU) (PEOU). The former refers to "a person's belief that using a particular system would improve his or her job performance," whereas the latter refers to "a person's belief that using a particular system would be effortless." 112. These two beliefs

foster a favorable disposition or intention toward using information technology, which has an effect on self-reported use 113.

Self-reported system usage and intended use studies have revealed that PU plays a significant role in determining these downstream effects. However, the majority of studies, beginning with Davis's, have failed to establish a direct link between PEOU and IT adoption. Indeed, one study concluded that "ease of use is mediated by usefulness" 114. A thesis that has been supported by subsequent research 110. Unsurprisingly, some research has cast doubt on the overall significance of PEOU in terms of IT adoption 115. However, the role of PEOU in TAM remains controversial, as some studies demonstrate that PEOU has a direct effect on either self-reported or intended IT use.

TAM is a well-researched model for predicting IT adoption. Originally, a study examined an e-mail system and a file editor used by IBM Canada at the time and discovered that both PEOU and PU were significantly correlated with self-reported use of both systems. When the combined effect of PU and PEOU on self-reported use was examined using linear regression, only PU had a statistically significant effect on self-reported use. Davis then asked 40 MBA students to evaluate two graphics systems with which they were previously unfamiliar in a follow-up study presented in the same paper. Prior to filling out the instruments, the subjects used workbook manuals to learn how to use both packages. The analysis of the MBA subjects' responses revealed that only PU predicted their intention to use the software for both graphic systems.

In a separate study, MBA students were asked to complete instruments about a word processor after spending an hour with it and again after 14 weeks. In contrast to the first study, Davis et al. discovered that PEOU had a significant effect on intended use after one

hour, even when the effect of PU on intended use was controlled. However, when the same subjects were reexamined 14 weeks later, this significant regression relationship became insignificant. In contrast to PEOU, PU had a significant effect on self-reported use across both time periods. Additionally, subsequent studies in the TAM research stream are inconsistent regarding the effect of PEOU on downstream effects and the mediating effect of PU 114.

**The model's relevance to the study.** One critical type of information sharing in this context is the dissemination of risk descriptions, for example, the results of risk assessments, to aid in decision-making about how to mitigate the long-term consequences of disasters. While risk descriptions are primarily used to aid in decision-making, they may also serve other purposes. They could be used to identify alternative decisions or to foster shared understanding among various stakeholders, for example. Nonetheless, the current study focuses on the extent to which they assist professionals involved in disaster risk reduction in making decisions. Numerous scholars have made significant contributions to the field of risk assessment and decision-making. Numerous contributions have been normative in nature, e.g. emphasizing methods for making decisions in uncertain situations. For instance, classical decision theory is concerned with decision-making in uncertain situations. Recently, several authors have made recommendations on how to manage risk in high-uncertainty situations. However, in this paper, we have taken a descriptive rather than a normative approach. As a result, we are more interested in how people actually make choices than in how they should make choices. The current study, however, is not concerned with the decision itself, but rather with the effect that various types of risk descriptions may have on decision-making. More precisely, we examined how the way

risk is described, i.e., how it is presented, affects the description's usefulness for decision-making as perceived by professionals, i.e. those involved in risk management and those who will use the descriptions. The empirical data for this study were derived from the Swedish system for disaster risk management<sup>1</sup>. The following is the structure of the paper. To begin, we review pertinent prior research in the area of communicating risk descriptions. Second, we provide a brief overview of the Swedish risk and vulnerability assessment (RVA) system, with a particular emphasis on the communication of risk-related information between the local, municipal, and regional levels via RVA documents. Thirdly, we provide an overview of the theoretical concepts discussed in the paper. Fourthly, we discuss the research methods employed. We then present the results and discuss the study's findings and limitations, as well as make some suggestions for future studies that might be interesting in light of our findings.

### **2.3 Empirical Framework**

**Perceived Ease of Use and Disaster Communication Practices;** TAM asserts that PEOU and PU are critical perceptions influencing IT adoption. In a subsequent study that expanded on the original TAM studies, the role of these beliefs was explained, with the conclusion that user intention to adopt new IT is influenced by both extrinsic and intrinsic motivations<sup>115</sup>. Extrinsic motivation refers to engaging in an activity for the sake of achieving valued outcomes that are distinct from the activity itself <sup>117</sup>. In comparison, "intrinsic motivation" refers to the act of performing an activity for no apparent reason other than the act of performing it.

Davis et al. classified enjoyment as an intrinsic motivation while PU was classified as an extrinsic motivation, arguing that extrinsic motivation should have a greater influence on

IT adoption. The reason PU is such a significant antecedent of IT adoption is that in many cases, a new IT is adopted primarily to facilitate the accomplishment of tasks that are not inherent in the use of the IT. PU is responsible for user evaluations of these aspects of a new IT 118. However, no discussion was made of the possible intrinsic or extrinsic contributions of PEOU to IT adoption 119. What they did assert was that PEOU would have an indirect effect on IT adoption via its effect on PU, as ease-of-use is critical in making a new IT more useful. However, the role of PEOU is likely to be more complicated than that. PEOU collects user feedback on the ease of use and learning. Thus, PEOU is concerned with user motivation, which is determined by an assessment of the intrinsic aspects of using the information technology, such as the interface and the process involved in using it. Arguably, because the extrinsic value of the IT (as captured by PU) and not its intrinsic value is frequently the reason for a new IT's adoption, this implies that PU, not PEOU, should have a direct impact on IT adoption. Much of the research on TAM appears to support this conclusion.

Nonetheless, PEOU should have an effect on IT adoption when the intrinsic characteristics of the IT, such as its interface clarity and navigational ease, contribute to the value of the end result for which the IT is being used.

This should occur conceptually when the output of the IT is inextricably linked to the interface, at which point the PEOU of the IT should directly correlate to the value placed on IT outcomes. Whether the motivation to use the new technology is intrinsic or extrinsic is determined by the nature of the task for which the new technology is being used, not by the technology itself. Thus, email usage can be an intrinsic task, such as simply informing, or an extrinsic task, such as specifically improving organizational performance through

improved communication. Regrettably, because the TAM studies cited rarely specify the nature of the task, it is frequently difficult to determine whether the IT studied was used for intrinsic or extrinsic purposes 120.

Despite this ambiguity, partial support for the preceding proposition may be deduced. With the exception of studies involving students and non-work-related settings in which subjects arguably did not use the IT for extrinsic tasks, the only instances in which PEOU had a direct effect on intended or actual use concerned either PC adoption or usage 121. These studies could be interpreted to support the study's central proposition. When it comes to PC adoption or utilization, ease of use is both an intrinsic property of the IT and a critical component of its extrinsic value. Additionally, for new users, ease of use of the IT (as measured by PEOU) is a critical factor in enabling users to derive extrinsic value from the IT, i.e., to perform a work-related task. Finally, many of the TAM studies that clearly focus on knowledge workers utilizing IT to accomplish work-related tasks demonstrate that PEOU had no direct effect on intended use 122. 1 Thus, a sizable proportion of the studies that did find a direct effect of PEOU on self-reported use may have focused on tasks intrinsic to the IT, as implied by the study's fundamental intrinsic-extrinsic proposition. 2

### Perceived Utility and Practices in Disaster Communication

The purpose of this study was to determine whether the task for which the IT is used directly affects the intention to use an IT. PEOU, which evaluates intrinsic IT characteristics, was hypothesized to have an effect on intended use only for tasks that are intrinsic to the IT, i.e., where the IT performs the primary process involved in the task. The data suggest that PEOU is a dynamic construct with varying levels and effects depending on the type of use of the IT 123. When viewed in this light, the findings may aid the field in

elucidating a critical issue in TAM research, namely when and why PEOU influences intention to use a system. Due to the lack of consensus among previous TAM-related studies, the significance and role of PEOU in these studies can only be assumed at this point. However, this study examined the varying effects of PEOU using the exact same subjects, research method, scenario, and measures. By adjusting for exogenous factors when comparing the two types of software use intentions, this study suggests that it is the task or intended use that appears to determine whether PEOU has an effect on use intention directly. These findings provide a preliminary answer to the questions raised in several TAM studies regarding the significance and role of PEOU. Additionally, the findings confirm previous findings in TAM-related research that PU is the primary belief influencing intentions to use an IT and support a study's conclusion that extrinsic motivation is more important than intrinsic motivation in IT adoption. 124.

Practitioners who may have been led to underestimate the importance of PEOU by previous TAM studies should reconsider the extent to which PEOU affects system use. PEOU is critical and does have an effect on intended use, but its effects are task-specific. As a result, when advertising, marketing, or implementing new systems, IT providers may find it advantageous to emphasize the ease with which the IT can be used for specific tasks rather than presenting it in a task-independent manner.

Web developers must bear in mind that ease of use will be especially critical when developing the search engines that will accompany their websites. These fundamental search engines, as well as the terms that enable advanced search, must be intuitive and clear to potential customers. 121. The portions of the site that process order and shipping

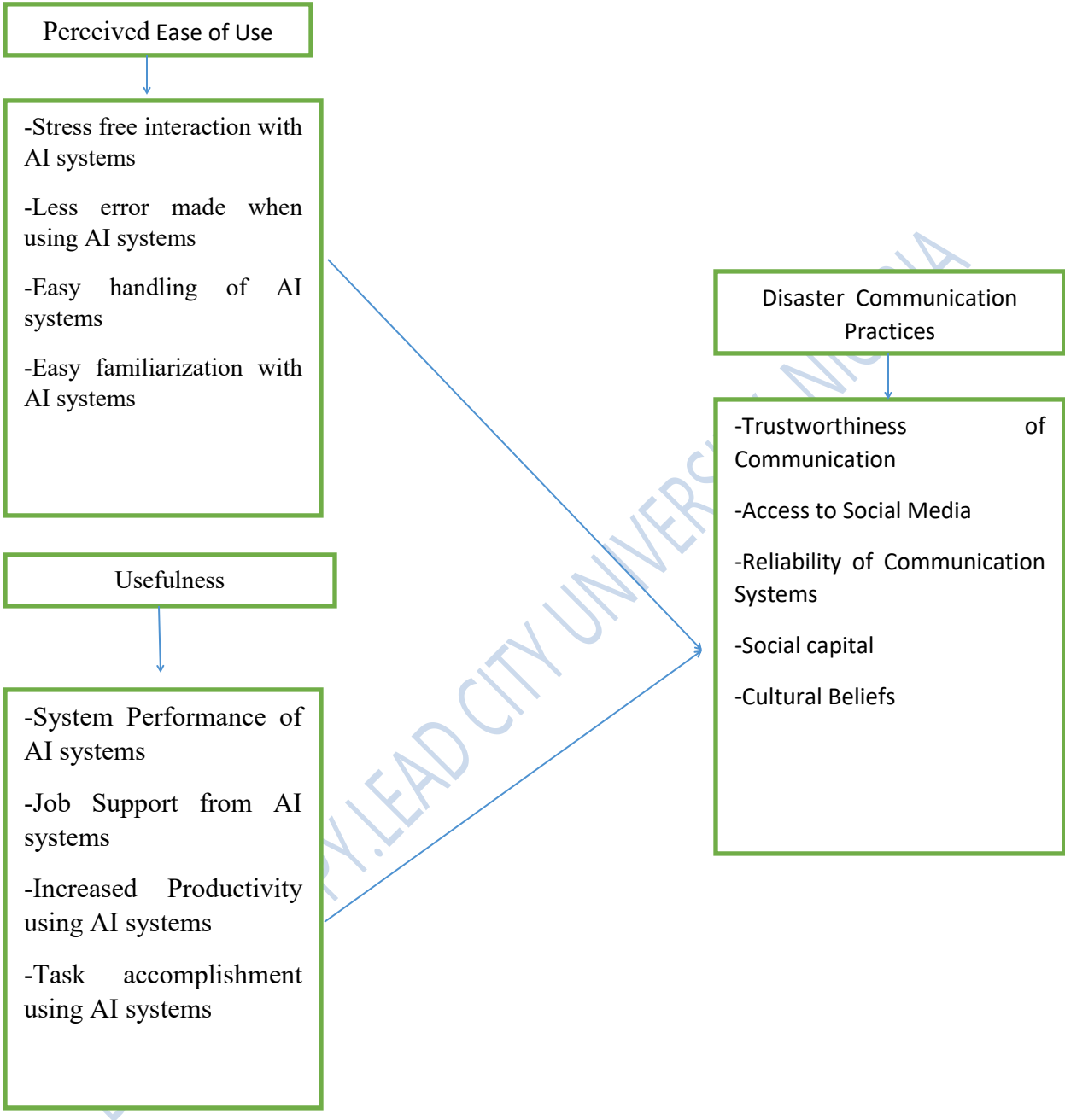
information and display collected data are less sensitive, as the customer is motivated by instrumental and extrinsic factors.

The theoretical contribution of the paper, from the perspective of TAM research, is to suggest an explanation for the variation in TAM studies regarding the relationship between PEOU and IT adoption. If confirmed by additional research, this finding would provide a more complete picture of the socio-psychological factors that influence the decision to use an information system. Thus, researchers should keep in mind that PEOU may be better studied in the context of a particular IT applied to a particular task and make predictions based on the nature of the task(s) for which the IT is primarily used. This reclassification of the effects of PEOU has the potential to improve the construct validity of this belief, which is a desirable outcome of any research 118. This clarification may also help to explain why previous TAM studies produced ambiguous results. The other component, the task, should be quantified and evaluated in all future TAM studies.

The technology acceptance model (Davis 1989) is a widely used model of information technology adoption. TAM asserts that two perceptions influence IT adoption: usefulness and ease-of-use. While research has demonstrated that perceived usefulness (PU) has an effect on intended adoption of IT, it has largely failed to demonstrate this effect for perceived ease of use (PEOU). The study's central proposition is that the varying importance of PEOU may be related to the task's nature. PEOU is concerned with evaluating the intrinsic characteristics of information technology, such as its ease of use, ease of learning, adaptability, and clarity of its interface. On the other hand, PU is a response to user evaluations of its extrinsic, or task-oriented, outcomes: how IT assists users in achieving task-related objectives such as task efficiency and effectiveness 123.

As a result, the study hypothesizes that PEOU has a direct effect on IT adoption only when the primary task for which the IT is deployed is directly related to intrinsic IT characteristics, such as when the task is a component of an IT interface. Extending this proposition to e-commerce, it was hypothesized that PEOU would have no effect on IT adoption when a Web site is used to purchase products because IT ease-of-use is not an inherent quality of the purchased product 124. On the other hand, when a Web site is used to inquire about products, PEOU should have an effect on IT adoption because the required information is embedded in the IT and thus its quality is directly related to the ease with which the IT can be used. These hypotheses are supported by data collected from 217 subjects in a free simulation experiment. The article discusses the implications for future Web development and theoretical refinements.

## Conceptual Model



**Conceptual model on perceived ease of use and usefulness on disaster communication practices, 2021.**

Figure 2.4 is a conceptualization of the independent (Perceived Ease of Use and Usefulness of AI) and dependent variable (Disaster Communication practices)

Secondly, the first independent variable of this study is Perceived Ease of Use. The indicators of this variable include: Stress free interaction with AI systems, Less error made when using AI systems, Easy handling of AI systems, Easy familiarization with AI systems.

Thirdly, the second independent variable of this study is Perceived Usefulness of AI. This variable describes the indicators which are: System Performance of AI systems, Job Support from AI systems, Increased Productivity using AI systems, Task accomplishment using AI systems.

Lastly, the dependent variable of this study is Disaster Communication practices . Disaster communication will have the following determinants: Trustworthiness of Communication, Access to Social Media, Reliability of Communication Systems, Social capital, Cultural Beliefs.

**Dependent Variable:** The dependent variable in this study, according to the conceptual model, is Disaster Communication practices. The following indicators will be used to assess disaster communication practices: communication trustworthiness, access to social media, communication system reliability, social capital, and cultural beliefs. Based on the self-efficacy theory. This dependent variable is related to the study's independent variables.

Artificial Intelligence (AI) has been demonstrated empirically to be a strong predictor of Disaster Communication Management. How satisfied professionals are with their use of AI at work has a significant impact on how they perform their jobs, which in turn has an effect on the management of the organization as a whole. To be precise, measuring disaster

communication management in this study cut across; trustworthiness of communication has been shown to be one of the best indicators of disaster communication management in that communication of trustworthiness as an interactive process affects, monitors, and guides members' actions and attitudes in their interactions with one another, which ultimately determines the level of trust between them. It is worth noting, however, that our definition of trust goes beyond the concept of "swift trust," in which "individuals in temporary groups initially rely on category-driven information processing to form stereotypical impressions of others." Thus, while our emphasis is on mechanisms for establishing trust in rapidly changing virtual environments, it is implicit that communication channels between cooperating parties are open. In this regard, research indicates that rapid trust cannot be sustained in the absence of subsequent communication. In effect, swift trust is a necessary but insufficient condition for trustworthiness communication.

Another indicator is access to social media, which is a broad term that refers to technologies that facilitate the creation, dissemination, and sharing of content via online communities and virtual networks. Additionally, social media demonstrates an emphasis on online networking and community building. These networks are built on the foundation of traditional offline relationships but are facilitated through online connections. Although social media is a relatively new technology, it has quickly become an integral part of modern communication. Social media also plays a critical role in disaster communication. Scholars examined how social media was used during various natural disasters and discovered that social media usage can be classified into two categories: passive dissemination of information (Personal Communication) and systematic use as an emergency management tool (Systematic Use). According to some studies, due to the

speculative nature and infancy of these applications, the primary purpose of social media in disaster communication is to disseminate information.

Another indicator was the reliability of communication systems, which was used to determine the disaster communication management in organizations in Nigeria that used AI. Professionals may have access to all genuine communications generated by the use of artificial intelligence. Reliability is critical for disaster management communication systems, as they may be deployed in remote regions that are not always accessible via conventional modes of communication, particularly in areas such as deep oceans and mountains. Occasionally, emergency rescue operations in remote locations, such as forest fires, avalanches, and landslides, rely heavily on the durability and reliability of the communication system – it must always be operational.

Another indicator is social capital, and research on social capital suggests that some form of social empowerment kicks in during and after a disaster. Studies of disasters have demonstrated that social capital can be used to better understand how vulnerable populations utilize available resources to meet immediate needs during a disaster.

Cultural Beliefs is the final indicator; it is deduced that while vital infrastructure has become more resilient to calamities as a result of disaster experiences, human behavior during disasters is frequently more difficult to control, especially in situations where people continue to occupy and settle in hazardous regions. Thus, it is critical to understand the sociocultural worldviews and behaviors of individuals involved in disaster management.

Variables that are not dependent

The study's first independent variable is Perceived Ease of Use. Numerous researchers have identified and discussed various aspects of AI varieties in this work. Scholars have recently

focused their attention on the following constructs: stress-free interaction with AI systems. Less error is made when using AI systems, AI systems are easier to handle, and AI systems are easier to familiarize with. However, these variables encompass all other aspects of AI usage, and each of these has a number of influencing factors that affect or are influenced by the weather management firms' internal strengths. According to the model, this study will examine the effect of the two variables as a means of bolstering the study on AI. Certain indicators indicate the extent to which an organization's use of AI is influential.

Perceived Usefulness is the second independent variable in the conceptual model. This is best understood through the eyes of the organizations' AI users. According to research, artificial intelligence is becoming a more prevalent technological tool in weather forecasting and meteorology institutes. The rate of adoption of AI varies according to field of study. The Perceived Usefulness indicators were adapted from TAM.

## **2.5 Gaps in of Literature**

This chapter reviewed pertinent literature to this research project. The concept of disaster communication management was reviewed for the literature, its meaning was explored, and empirical findings on the use of AI in the management of natural disasters in various organizations were discussed. The review of the literature on the performance of the organizations in question revealed that disaster communication management includes components such as communication trustworthiness, access to social media, communication system reliability, social capital, and cultural beliefs.

The literature provides an in-depth examination of the various interpretations of perceived ease of use in relation to the need and demand for the use of AI. This has been augmented by the requirement to deal with the diverse environmental and natural disasters of the

modern era. AI is the technological aspect of creating and developing concepts, operational techniques, products, and processes that aid in reducing environmental impacts or achieving environmental sustainability in response to the government and market's ever-increasing pressure on mechanized sustainability, developing an effective and efficient management program, and establishing a permanent significant component for firms' management programs through the use of various. The two metrics for determining the rate at which AI is being used across disaster management organizations have been identified as perceived ease of use and perceived usefulness.

Public organizations are becoming more interested in crisis communication in the event of major accidents, natural disasters, and humanitarian crises. The purpose of this study is to identify communication gaps in disaster management practice, with a particular emphasis on the difficulties associated with stakeholder-specific communication during the various stages of a crisis event and on cooperation within the crisis response network. Previously, management and communication gaps in specific crisis events have been studied. This essay looks beyond specific crises and adopts a more broad perspective. Similar issues have arisen in a variety of crisis situations, but the lessons learned have not resulted in practical solutions. We compiled data on the most prevalent gaps in disaster communication today using an international questionnaire. Despite the academic field's brief existence, at least in Europe, the body of knowledge in crisis communication is relatively rich. In the United States of America, crisis communication has long been a focus of research and practice in public relations, particularly in reputation management and image restoration 111. However, in the area of disaster management by public organizations, the communicative aspects of crises were neglected for many years, and crisis communication did not establish itself as a

distinct research field until after the 1986 Chernobyl disaster 112. Following major catastrophes and natural disasters, such as the Tsunami and Hurricane Katrina, growing uncertainty, an increase in the number and magnitude of crises, and public criticism of government crisis communication have pushed the subject to the top of the priority list for public organizations.

Crises frequently catch organizations and people off guard, create perilous circumstances, and necessitate an immediate response from those responsible 114. They necessitate quick decision-making. Crises can be classified as either intentional (terrorism, sabotage, workplace violence, and unethical leadership) or unintentional (natural disasters, disease outbreaks, unforeseeable technical interaction, and product failure) 115. The focus of this paper will be on unintentional crises, one of which is disaster, which refers to a situation that poses a threat to life, health, or the environment and to which public authorities and non-governmental organizations (NGOs) are the primary responders.

Public authorities have a mandate to serve the public interest and to ensure citizens' safety through effective crisis management. In this context, response organizations refer to government agencies and rescue organizations that are required by law to prepare for and manage crises 116. These organizations are responsible for disaster management within their respective spheres of authority. However, today's crises are becoming increasingly complicated, necessitating the simultaneous involvement of numerous organizations. The larger and more severe a crisis is in terms of magnitude and negative consequences, the more actors from various societal sectors on a national, regional, and local level will be involved in its management. Global risks and crises also necessitate the collaboration of public and non-governmental organizations on a transnational scale. NGOs are currently

involved in a variety of large-scale natural disasters and humanitarian relief efforts on a global scale. When these factors are considered, it becomes clear that collaboration within a network of response organizations is difficult. This is true for both operational and communication tasks<sup>117</sup>.

The purpose of this study is to identify gaps in communication supporting disaster management caused by artificial intelligence that have been observed in practice. It is a component of a larger research project that aims to develop an audit instrument with indicators for assessing and improving disaster communication. The indicators should be based on critical factors identified in the literature but should also account for constraints encountered by previous instrument users. The current study discusses some significant insights into disaster communication that have been published in the literature, but focuses on clarifying views on constraints in current disaster communication practice<sup>124</sup>.

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### **Chapter Three**

#### **Research Methodology**

This chapter gives the methodology used in undertaking the study. This includes research design, population, sample and sampling design. It also pinpoints the data collection

instruments, data collection procedures, data analysis and presentation as well as ethical considerations respectively.

### **3.1 Research Design**

This research work made use of descriptive survey research design. This design describes a phenomenon that can be investigated into. This made the design suitable for this research as the researcher sought to describe existing phenomenon thereby asking about the use of artificial intelligence on disaster communication practices. Descriptive survey design enables the researcher to collect data for the purposes of describing and measuring the characteristics of a population which is too large to be observed directly.

### **3.2 Population of the Study**

The total population for this study is 120 technical staff of the two disaster-prevention agencies in Nigeria. The two agencies are: National Emergency Management Agency of Nigeria (NEMA) and Nigerian Meteorological Agency (NIMET).

### **3.3 Sample Technique and Sample Size**

Total enumeration sampling technique is used for this study because it covers all the targeted respondents for this study. The targeted respondents are all technical staff of the two disaster prevention agencies mentioned in above.

### **3.4 Description of Research Instruments**

The researcher collected data for this study using a questionnaire. This study's questionnaire was divided into two sections. The researcher's questionnaire is labeled: Perceived Ease of Use and Perceived Usefulness of Artificial Intelligence (PEUPUAI). The researcher stated

five research questions for this study and designed the questionnaire along the identified objectives of the study. Hence, the research instrument will be divided into four sections: A, B, C and D. Items in the instrument was gathered from the literature reviewed for this study.

**Section A** will be designed to elicit responses on demographic characteristics such as name of company and years of working experience.

**Section B** will center on items that captured data on the Disaster Communication practice level Nigeria.

**Section C** will contain items on Perceived Ease of Use of AI. All the response format of the items in this section will follow the pattern of a five Likert scale ranging from 4-Strongly Agree to 0-Undecided.

**Section D** will have items on Perceived Use of AI. All the response format of the items in this section followed the pattern of a five Likert scale ranging from 4-strongly agree to 0-Undecided.

### **3.5 Validation of the Research Instruments**

To ensure validity of the instrument for this study, the questionnaire was given to the researcher's supervisor for face and content validity.

### **3.6 Reliability of the Research Instrument**

For internal consistency to be recorded in the research instrument, 30 copies of the research instrument was distributed to employees of these three disaster agencies in state ministries of Lagos state and Kaduna state. The Cronbach alpha coefficient result reveals the following:

Section B: 0.75, Section C: .89, Section D: 0.78. It is believed that any Cronbach alpha coefficient value that is above 0.70, such coefficient value is adjudged to be reliable.

### **3.7 Method of Data Collection**

Two research assistants assisted the researcher in questionnaire administration done through face to face interactions. The research assistants were selected as per their knowledge of the region, people and understanding of the local language. The assistance of the Heads of Department was sought to ease the administration of the questionnaire.

### **3.8 Method of Data Analysis**

Data collected was checked, coded and transcribed for data analysis. The data collected in this study was analyzed using descriptive statistics. The Statistical Package for Social Sciences (SPSS version 23) software was used to carry out these analyses. Standard and mean deviation will be used to analyze the research questions while regression and multiple regression was used to analyze the hypothesis for this study.

### **Endnote**

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## Chapter Four

### Results and Discussion of Findings

This chapter presents the result of the analysis of collected data. Descriptive and inferential statistics were both employed in the analysis of data, while appropriate discussion was done on the findings revealed. Therefore, this chapter is presented under the following sub-headings:

- 4:1 Demographic Presentation of Data
- 4:2 Presentation of Result Based on Research Questions
- 4:3 Hypotheses Testing and Interpretation
- 4:4 Discussion of Findings

#### 4:1 Demographic Presentation of Data

**Table 4.1.1 Gender of Respondents**

		Frequency	Percent
Valid	Female	43	46.2
	Male	50	53.8
	Total	93	100.0

**Source: Field Survey, 2021**

From the above table (Table 4.1.1), reveals the gender distribution of respondents for this study. It was revealed that male respondents are a total number of 50 (53.8%) while female respondents are of 43 (46.2%). Therefore, it is not out of place to say that disaster control agencies in Nigeria have more male than female employees.

**Table 4.1.2****Age of Respondents**

		Frequency	Percent
Valid	21-25	10	10.8
	26-30	7	7.5
	31-35	17	18.3
	36-40	19	20.4
	41-45	16	17.2
	46-50	24	25.8
	Total	93	100.0

**Source: Field Survey, 2021**

Table 4.1.2 is associated with the age of respondents for this study. Age range of 46 – 50 years happens to be the dominant age of respondents of employees in agencies that are responsible for curbing disasters in the country. This age range has it that 24 respondents attested that they belong to this age range. 19 respondents expressed the fact that they belong to the age range of 36 – 40 years of age. 17 respondents are of the age range of 31 – 35 years of age. 16 of the respondents are of the age range of 41 – 45 years of age while 10 respondents say they fell within the age range of 21 25 years of age. 7 say they are within the age range of 26 – 30. The implication of this age range is the fact that employees working disaster prevention agencies are pretty much agile and are still very much active in their prime of service.

**Table 4.1.3 Educational Qualification of Respondents**

		Frequency	Percent
Valid	BSc/HND	56	60.2
	MA/MSc	33	35.5
	PhD	4	4.3
	Total	93	100.0

**Source: Field Survey, 2021**

Table 4.1.3 is based on the educational qualification of employees working in disaster prevention agencies in Nigeria. Interestingly there are 4 doctorate degree holders in these agencies, 33 possess second degrees while 56 have the first degree. This implies that employees in disaster prevention agencies in Nigeria are very much educated which also means that they are well informed.

**Table 4.1.4 Years of Work Experience**

		Frequency	Percent
Valid	1-3 Years	54	58.1
	4-6 Years	29	31.2
	7 years and above	10	10.8
	Total	93	100.0

**Source: Field Survey, 2021**

Table 4.1.4 is associated with years of work experience of employees in disaster prevention agencies in Nigeria. 29 respondents say that they have spent between 4-6 years in these agencies. 54 respondents are of the opinion that they have spent about 1-3 years while 10 say they have spent close to 7 years and above. This implies that these employees are well versatile in their respective fields of operation.

#### **4.2 Presentation of Results Based on Research Questions**

**Research Question One:** What is the level of disaster communication practices among employees of disaster prevention agencies in Nigeria?

**Table 4.2.1: Disaster Communication Practices**

S/N	Statement	SA (%)	A (%)	D (%)	SD (%)	UD (%)	Mean	SD
	Various communication systems existing in my organization to combat disasters in my country is effective and efficient	52 (55.9)	30 (32.3)	-	11 (11.8)	-	3.44	.699

My colleagues can handle	48	37	2	6	-	3.41	.711
various communication	(51.6)	(39.8)	(2.2)	(6.5)			
systems existing in my							
Organization.							
Communication systems existing	36	45	2	10	-	3.24	.728
In my organization to combat	(38.7)	(48.4)	(2.2)	(10.8)			
Disasters in my country are adequately							
Maintained from time to time.							
Budget allocated for the purchase	41	32	5	15	-	3.17	.832
and maintenance of communication	(44.1)	(34.4)	(5.4)	(16.1)			
Systems in my organization are							
Well managed.							
Existing communication systems	30	30	17	16	-	2.78	1.092
In my organization do not need	(32.3)	(32.3)	(18.3)	(17.2)			
Urgent replacement.							
When it comes to disaster management	29	43	5	16	-	3.03	.840
In my country, I trust every form of	(31.2)	(46.2)	(5.4)	(17.2)			
Communication between me and my							

Colleagues and boss.

The communication flow from the 37 37 - 19 - 3.19 .756

Management of my organization (39.8) (39.8) (20.4)

To the very least personnel in my

Organization is trustworthy.

In combating disaster in my 33 45 2 13 - 3.17 .746

Organization, feedback mechanism (35.5) (48.4) (2.2) (14.0)

Between myself, colleagues and my

Organizational heads is highly effective.

Myself and my colleagues do receive 32 47 4 10 - 3.15 .779

Timely information about disaster (34.4) (50.5) (4.3) (10.8)

Occurrences in different parts of my

Country.

Myself and my colleagues are very 35 40 2 16 - 3.16 .784

Much proactive in terms of responding (37.6) (43.0) (2.2) (17.2)

To information as regards disaster

Happenings in my country.

I as an employee of a disaster-	29	29	5	30	-	2.88	.919
Prevention related organization	(31.2)	(31.2)	(5.4)	(32.3)			
Can categorically say that there has							
Never been cases of communication gap							
In my between my boss and his or her							
Subordinates when it comes disaster management.							
All in all, I think disaster communication	13	35	4	41	-	2.61	.781
Practices in my organization is pretty	(14.0)	(37.6)	(4.3)	(44.1)			
much reckonable.							

**Average Mean: 3.10 on a 5 point scale.**

Table 4.2.1 is associated with the first research question for this study which says that “What is the level of disaster communication practices among employees in disaster prevention Agencies in Nigeria?.

Therefore it can be realized from the Table 4.2.1 that the disaster communication practices among employees in disaster prevention Agencies in Nigeria is high level. This is reflected in the overall mean score of 3.10 on a five point scale on the level of disaster communication practices, progressing to other organizational performance such as various communication systems which has a mean score of 3.44 on a five point scale. In this case employees are not so effective and efficient when it comes to communication in the organization, going by other constructs of organizational performance has a mean score of 3.41. This implies that my colleagues can handle

various communication systems existing in my Organization and these actually reduce the level of disaster communication practices in Nigeria.

Communication system as one of the disaster communication practises has a mean score of 3.24 which implies that this constructs is on low level than previous or above disaster communication practices because it's adequately maintained from time to time. Budget allocated for the purchase maintenance of communication systems in my organization is another component of disaster communication practices which has the mean of .3.17 it shows that there is reduction of communication through the budget allocation to the organization.

Another component of disaster communication is the existing communication systems which has a mean of 2.78. This is at smallest low level of disaster communication reasons is that the existing communication system is still found in the system which may interrupt new communication that is coming therefore there is need of urgency of replacement in other to override the communication system. Moreover, The communication flow from the management of my organization with mean score of 3.19 display the common level of disaster communication because it's shows how the least personnel in my Organization is trustworthy. Another construct of organizational performance of disaster communication in this study is disaster management with mean score of 3.03 and the tendency of keeping the communication secretly is very low level because trusting every form of communication between me and my colleagues and boss.

Furthermore, Combating disaster as another construct of organizational performance has a mean score of 3.17. This implies that the organization gives feedback mechanism between myself, colleagues and organizational heads is highly effective. Based on the other item on disaster communication is Timely information which has a mean of 3.15 this produce the absolute level

of disaster communication reason why myself and my colleagues do receive information about disaster occurrence's in different parts of my Country.

Finally, another constructs of organizational performance is Proactive in terms of responding to information as regards to disaster with average mean score of .3.16. Disaster-Prevention as another construct of organizational performance of disaster communication with mean score of 2.88 this show there is no gap of communication that occur between my boss and his or her Subordinates when it comes to disaster management. In conclusion, All in all I think disaster communication Practices in my organization is pretty much reckonable with mean score of 2.61 this is also at low level on a five point scale.

**Research Question Two:** What are the various communication practices among employees in disaster prevention agencies in Nigeria?

**Table 4.2.2: Perceived Ease of Use of AI Applications.**

S/N	Statement	SA (%)	A (%)	D (%)	SD (%)	UD (%)	Mean	SD
1.	Some AI applications deployed to My organization to combat disaster Occurrences in my organization Are rigid to use while some are flexible to use.	49 (52.7)	29 (31.2)	-	15 (16.1)	-	3.37	.749
2.	I get frustrated at times when making 1.121 Use of AI applications in my office.	27 (29.0)	25 (26.9)	20 (21.5)	21 (22.6)	-	2.63	
3.	AI applications existing in my 3.02 Organization to combat or Prevent disasters in my country is just too Sophisticated to handle.	31 (33.3)	40 (43.0)	7 (7.5)	15 (16.1)	-		
4.	Many of my colleagues assigned to 3.09 .880	33	42	7	11	-		

Handle AI applications in my (35.5) (45.2) (7.5) (11.8)

Organization for disaster management

Are not well qualified.

5. Remembering various instructions 16 33 9 35 -

2.60 .886

On how to handle AI application for (17.2) (35.5) (9.7) (37.6)

Disaster management in my organization

Is really difficult to remember.

6. I get easily distracted when it comes 15 41 11 26 -

2.65 .893

To handling AI applications for (16.1) (44.1) (11.8) (28.0)

Disaster management in my organization.

7. There has been no adequate training 28 40 2 23 -

3.01 .801

Organized by my organization on (30.1) (43.0) (2.2) (24.7)

How to handle AI applications.

8. Regardless of how I am trained to 28 29 8 28 -

2.83 .963

Handle AI applications in my (30.1) (31.2) (8.6) (30.1)

Organization, it is still a big challenge

For me in remembering how to

Handle these applications.

9. Manual Instructions on how to handle 16 31 - 46

AI applications deployed to my (17.2) (33.3) (49.5) -

2.68 .754

Organization are not easy to understand.

10. Language use on instructions on how 15 55 2 21 -

2.89 .683

To handle AI applications in my (16.1) (59.1) (2.2) (22.6)

Organizations are easy to comprehend

11. Despite how easy it seems to 26 47 5 15 -

3.01 .814

Understand instructions on how (28.0) (50.5) (5.4) (16.1)

To handle AI applications in my

Organization, I will still need physical

Explanation on how to handle these AI apps.

12. All in all, I think AI apps deployed to 12 32 8 41 -

2.52 .829

My organization to combat disasters (12.9) (34.4) (8.6) (44.1)

Are not easy to understand.

**Average mean score = 2.63**

**34.3**

**12**

Table 4.3 reveals a dominance of AI applications existing in communication practices among employees in disaster prevention agencies in Nigeria and with the Use of AI applications in my office having mean score of 3.37 and 2.63 respectively. Though both mean score are at absolute range with average mean score of the five point scale which is 2.63, this implies that employees in Federal Government Agencies in Nigeria are of the opinion that most of their AI application are rigid to use while some are flexible to use.

Furthermore, Part of the items listed in the statement such as: “AI application existing in my Organization to combat or Part of the items listed in the statement such as AI application existing in my Organization to combat or Prevent disasters in my country or Prevent disaster in my country is just too sophisticated to handle”, “Many of my colleagues assigned to Handle AI application in my Organization for disaster management Are not well qualified” , “Remember various instructions On how to handle AI application for Disaster management in my Organization Is really difficult to remember.” , “I get easily distracted when it comes to handling AI application for Disaster Management in my organization.” Had mean score of 3.02, 3.09, 2.60, and 2.65, respectively. The result showed that employees in my organization strongly agreed with the statement.

Finally, Items such as; “There has been no adequate training Organized by my organization on How to handle AI application” , “Regardless of how I am trained to Handle AI applications in my Organization, it is still a big challenge For me in remembering how to Handle these application”, “Manual Instructions on how to handle AI applications deployed to my Organization are not easy to understand” , “Language use on Instructions on how To handle AI application in my Organization are easy to comprehend” , “Despite how easy it seems to Understand instructions on how To handle AI application in my Organization, I will still need physical Explanation on how to handle these AI apps.” , “All in all, I think AI apps deployed to My organization to combat disasters Are not easy to understand” have mean scores of 3.01, 2.83, 2.68, 2.89, 3.01 and 2.52 respectively. These scores also show that employees strongly agreed with these items which implies that indeed disaster communication practices in federal government agencies in Nigeria perceive ease of use of AI application.

**Research Question Three:** What is the level of usefulness of artificial intelligence applications existing disaster prevention agencies in Nigeria?

**Table 4.2.3: Usefulness of AI applications**

S/N	Statement	SA	A	D	SD	UD	Mean	SD
		(%)	(%)	(%)	(%)	(%)		

1. AI applications deployed to my	28	46	3	16	-	3.06	.777
Organization makes the job of	(30.1)	(49.5)	(3.2)	(17.2)			
Disaster management easier for me.							
2. AI applications used in my	31	47	3	12	-	3.14	.760
Organization to combat	(33.3)	(50.5)	(3.2)	(12.9)			
Disasters are pretty much relevant.							
3. AI applications in my	31	46	2	14	-	3.14	.746
Organizations have really	(33.3)	(49.5)	(2.2)	(15.1)			
Contributed a lot in solving							
Difficult tasks in the context of							
Disaster management.							
4. Without AI applications	18	41	8	26	-	2.74	.871
Deployed to my organization	(19.4)	(44.1)	(8.6)	(28.0)			
To combat disasters, combating							
Disasters would have been nothing							
To write home about.							
5. The use of AI applications	35	36	4	18	-	3.10	.861

In my organization has (37.6) (38.7) (4.3) (19.4)

Enabled my organization to

Prevent more disasters from occurring.

6. AI applications existing in my 42 39 4 8 - 3.28 .799

Organization has made disaster (45.2) (41.9) (4.3) (8.6)

Happenings minimal than what

It used to be before.

7. I suggest that stakeholders in 38 34 - 21 - 3.18 .779

Disaster management in my (40.9) (36.6) (22.6)

Country should get more

AI applications for disaster management.

8. Without AI applications I see 35 30 6 22 - 3.01 .938

No way how myself and my (37.6) (32.3) (6.5) (23.7)

Colleagues will prevent disasters

From occurring in my country.

9. The Federal Government Should. 52 21 5 15 - 3.29 .928

Make the deployment of AI (55.9) (22.6) (5.4) (16.1)

Applications in preventing disaster

Occurrences their priority all the time.

10. AI applications are pretty much 6 52 4 31 - 2.65 .670

Critical to my job. (6.5) (55.9) (4.3) (33.3)

11. The present AI applications 20 39 2 32 - 2.83 .789

My organization is using are (21.5) (41.9) (2.2) (34.4)

Top-notch.

12. Without AI applications 2 51 15 25 - 2.43 .786

Deployed to my (2.2) (54.8) (16.1) (26.9)

Organization to combat disasters

, I will resign my job

13. All in all, AI applications 10 42 14 27 - 2.52 .880

Deployed to my organization (10.8) (45.2) (15.1) (29.0)

To combat and prevent disasters

From re-occurring are highly critical to my job

**Mean Score=34.3, Total Items= 12**

**38.37**

**—13—**

**Average mean score = 2.95**

Table 4.3 shows that the level of usefulness of artificial intelligence applications existing disaster prevention agencies in Nigeria is at high level judging by the average mean score of 2.12 on a five point scale. With a mean score of 3.06 which is rather low level, it is evident that employees were of the opinion that AI application deployed to the organization makes the job of disaster management easier for me. Combat disaster as another construct of employee use AI application used to fight disaster communication had the least of mean score of 3.14. Based on the other constructs in the table shows how AI application in organization contribute a lot in other to solve difficult tasks in the context of disaster management with mean score of 3.14.

Furthermore, statement such as: “Without AI application deployed to my organization to combat disasters, combating disasters would have been nothing to write home about” , “The use of AI applications In my organization has made disaster has enabled my organization to prevent more disasters from occurring” , “AI applications existing in my Organization has made disaster Happenings minimal than want it used to be before” , “I suggest that stakeholders in disaster management in my country should get more AI applications for disaster management” had mean scores of 2.74, 3.10, 3.28 and 3.18, respectively. The result showed the usefulness of AI application at high level thought not too high. This revealed that the use of AI application will be able to combat and prevent disaster in the country.

Also items such as: “Without AI application I see No way myself and my colleagues will prevent disasters from occurring in my country” , “The Federal Government should make the deployment of AI application in preventing disaster occurrence’s their priority all the time” ,”AI application are pretty much critical to my job” , “The present AI applications my organization is using are Top-notch” had mean score of 3.01, 3.29, 2.65 and 2.83 , respectively. The use of AI application at this level is high and it display that without any equipment of AI application in the

organization the level at which disaster will increase it will be high and if there is no deployment of AI application from federal government to prevent disaster it will be a critical issues in the country.

Finally, items such as: “Without AI applications Deployed to my Organization to combat disasters I will resign my Job” , “All in all, AI applications deployed to my organization to combat and prevent disaster from re-occurring are highly critical to my job” had mean score of 2.83, 2.43 and 2.52, respectively which is at high level but not so high . This implies that the level of disaster which will occur due to unreasonable decision by not deployed AI applications will make some staff to resign there job because there is no way they can combat with the disaster without the use of AI application.

#### 4:3 Hypotheses Testing and Interpretation

Ho1: Perceived Ease of Use of artificial intelligence applications will not significantly influence disaster communication practices of employees in disaster prevention agencies.

#### Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.250 <sup>a</sup>	.062	.052	.43027

a. Predictors: (Constant), perceived\_ease\_of\_use

**ANOVA<sup>a</sup>**

		Sum of				
Model		Squares	df	Mean Square	F	Sig.
1	Regression	1.120	1	1.120	6.052	.016 <sup>b</sup>
	Residual	16.847	91	.185		
	Total	17.967	92			

a. Dependent Variable: disaster\_communication\_practices

b. Predictors: (Constant), perceived\_ease\_of\_use

**Coefficients<sup>a</sup>**

		Unstandardized		Standardized		
		Coefficients		Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	2.386	.295		8.084	.000
	perceived_ease_of_use	.251	.102	.250	2.460	.016

a. Dependent Variable: disaster\_communication\_practices

b. Perceived\_ease\_of\_use

**R = .256 R Square = .062, F = 6.052, P = .016.**

As shown in Table 4.3,  $F = 6.052$ ,  $P < .05$  which is less than 0.5 level of significance suggested that over all, the regression model statistically significantly predicted the outcome variable – disaster communication practices. Furthermore, the analysis revealed that perceived ease of use ( $\beta = 0.000$ ,  $P < .05$ ) did not significantly influenced organizational performance. Therefore, the null hypothesis was rejected.

**Ho2:** Usefulness of artificial intelligence applications will not significantly influence disaster communication practices of employees in disaster prevention agencies in Nigeria.

### Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.513 <sup>a</sup>	.263	.255	.38151

a. Predictors: (Constant), usefulness\_of\_artificial\_intelligence\_applications

### ANOVA<sup>a</sup>

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.722	1	4.722	32.443	.000 <sup>b</sup>
	Residual	13.245	91	.146		
	Total	17.967	92			

a. Dependent Variable: disaster\_communication\_practices

b. Predictors: (Constant), usefulness\_of\_artificial\_intelligence\_applications

## Coefficients<sup>a</sup>

Model		Unstandardized Coefficients		Standardized Coefficients		t	Sig.
		B	Std. Error	Beta			
1	(Constant)	1.073	.359			2.992	.004
	usefulness_of_artificial_intelligence_applications	.688	.121	.513		5.696	.000

### a. Dependent Variable: disaster\_communication\_practices

Table 4.2 shows that, overall, there is an influence between the dependent variable (Disaster communication practice), R-square = 51% of the variation in the dependent variable that is explained by the independent variable. Besides, (F = 32.443, P = .000) indicated a statistically significant influence of the independent variables on disaster communication performance. Additionally, the analysis revealed that usefulness of artificial intelligence application ( $\beta = 0.513$ ,  $P < .05$ ) were found to have statistically and significantly that the usefulness of artificial intelligence applications did not significantly influence disaster communication practices of employees of disaster prevention Agencies in Nigeria. The null hypothesis was also rejected.

**H03:** Joint influence of perceived ease of use and usefulness of artificial intelligence applications will not significantly influence disaster communication practices of employees in disaster prevention agencies in Nigeria.

### Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.570 <sup>a</sup>	.325	.310	.36708

a. Predictors: (Constant), usefulness\_of\_artificial\_intelligence\_applications, perceived\_ease\_of\_use

### ANOVA<sup>a</sup>

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.840	2	2.920	21.670	.000 <sup>b</sup>
	Residual	12.127	90	.135		
	Total	17.967	92			

a. Dependent Variable: disaster\_communication\_practices

b. Predictors: (Constant), usefulness\_of\_artificial\_intelligence\_applications, perceived\_ease\_of\_use

### Coefficients<sup>a</sup>

Model		Unstandardized		Standardized		Sig.
		B	Std. Error	Beta	t	
1	(Constant)	.357	.425		.839	.404

perceived_ease_of_use	.251	.087	.249	2.880	.005
usefulness_of_artificial_intelligence_applications	.688	.116	.513	5.918	.000

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**a. Dependent Variable: disaster\_communication\_practices**

As shown in Table 4.3,  $F = 21.670$ ,  $P < .05$  which is less than 0.05 level of significance suggested that over all, the regression model statically significantly predicted the outcome variable of disaster communication practices . In conclusion, the analysis showed that perceived ease of use ( $\beta = 0.249$ ,  $P < .05$ ) and usefulness of artificial intelligence applications ( $\beta = 0.513$ ,  $P < .05$ ) was found not not significantly influence disaster communication practices of employees in Federal Government Agencies. Therefore, the null hypotheses were also rejected.

#### 4.4 Discussion of Findings

**Research Question One:** What is the level of disaster communication practices among employees in disaster prevention agencies in Nigeria? Basically, the level of disaster communication practices among employees in disaster prevention agencies is at 3.10 on a scale of 5 with a decision rule of 2.50. This implies that to a large extent disaster communication practices is pretty much worth it in Federal Government disaster preventive agencies in Nigeria. A study revealed that disaster communication practices in an organization when effective will definitely enable an organization to be proactive and respond to disasters in any part of the country.

**Research Question Two:** What are the various communication practices among employees in disaster prevention agencies in Nigeria? The various communication practices existing in disaster preventive Federal Government agencies has a whole lot to do with many of the items in this section of the survey research work. Items such as; “There has been no adequate training Organized by my organization on How to handle AI application” , “Regardless of how I am trained to Handle AI applications in my Organization, it is still a big challenge For me in remembering how to Handle these application”, “Manual Instructions on how to handle AI applications deployed to my Organization are not easy to understand” , “Language use on Instructions on how To handle AI application in my Organization are easy to comprehend” , “Despite how easy it seems to Understand instructions on how To handle AI application in my Organization, I will still need physical Explanation on how to handle these AI apps.” , “All in all, I think AI apps deployed to My organization to combat disasters Are not easy to understand” have mean scores of 3.01, 2.83, 2.68, 2.89, 3.01 and 2.52 respectively. These scores also show that employees strongly agreed with these items which implies that indeed disaster communication practices in federal government agencies in Nigeria perceive ease of use of AI application. However, many of the items in this aspect of the survey were just at the average level.

**Research Question Three:** What is the level of usefulness of artificial intelligence applications existing in disaster prevention agencies in Nigeria? The level of usefulness of artificial intelligence applications was at a level of 2.95 on a five point scale with a decision rule of 2.50. What this implies is that the usefulness of artificial intelligence applications is just at an average level. A study revealed that when artificial intelligence applications is at an average level, it

might not be too useful <sup>2</sup>. On the contrary, a study revealed that for the fact that an A.I application is at an average level, does not mean that the A.I applications are not useful <sup>3</sup>.

**Hypothesis:** The first null hypothesis in this study says that “Perceived Ease of Use of artificial intelligence applications will not significantly influence disaster communication practices of employees in disaster prevention agencies”. The result of this finding buttresses the fact that the null hypothesis has to be rejected. Reason being that the probability level is below 0.05 level of significance which is the yardstick of significance level for this study. This implies that Perceived Ease of Use of artificial intelligence applications will significantly influence disaster communication practices. Though with a linear relationship of 25% between Perceived Ease of Use and disaster communication practices shows that the relationship between the two variables is not too strong. This finding is actually in line with a finding in a study that revealed that Perceived Ease of Use of artificial intelligence applications will significantly influence disaster communication practices <sup>4</sup>.

The second hypothesis in this study says that “usefulness of artificial intelligence applications will not significantly influence disaster communication practices of employees in disaster prevention agencies”. The result of this null hypothesis prompted the researcher to reject this null hypothesis. The reason is simply based on the fact that the probability level is below the level of significance which is 0.05. The linear relationship between usefulness of artificial intelligence applications and disaster communication practices was at a percentage level of 51.3%. This means that the relationship between this two variable is just at an average level. From a hypothetical perspective, this implies that usefulness of artificial intelligence applications will significantly influence disaster communication practices. This affirms the finding of a study that revealed that usefulness of artificial intelligence applications will significantly influence disaster

communication practice<sup>5</sup> . However, another study conducted in Poland showed that usefulness of artificial intelligence applications will not significantly influence disaster communication practices<sup>6</sup>.

The last null hypothesis for this study is from a multiple regression perspective. The null hypothesis says ‘Joint influence of perceived ease of use and usefulness of artificial intelligence applications will not significantly influence disaster communication practices of employees in Federal Government Agencies’. Interestingly, this combined null hypothesis revealed that both independent variables were significant to the dependent variable – disaster communication practices. This was so because the two independent variables had a probability level of 0.05 and 0.00 which is below the significance level of 0.05. This hypothesis also showed that the combined relationship of the two independent variable with the dependent variable was at a percentage level of 57%. This means that with the combination of the two independent variables of this study, only a 57% relationship does it have with the dependent variable.

## Endnotes

1. Written evidence from Royal College of Radiologists (AIC0146) to the House of Lords Select Committee on Artificial Intelligence; Hainc
2. D. Wang, The bright, artificial intelligence-augmented future of neuroimaging reading Front Neurol 8: 489, (2014).
3. A. Adewale, Deep learning for identifying metastatic breast cancer arXiv preprint arXiv:160605718; (2016).
4. A. Esteva, Dermatologist-level classification of skin cancer with deep neural networks Nature 542: 115, (2019).
5. P. Rajpurkar, CheXNet: Radiologist-level pneumonia detection on chest x-rays with deep learning arXiv preprint arXiv:171105225; (2017).
6. Moorfields Eye Hospital, DeepMind Health Q&A. See <http://www.ultromics.com/technology/>, (2018).

## Chapter Five

### Conclusion

#### 5.1 Summary of Findings

This work studied Perceived Ease of Use and Usefulness of Artificial Intelligence Systems on Disaster Communication Practices in Nigeria. Determinants such as Trustworthiness of Communication, Access to Social Media, Reliability of Communication Systems, Social capital, Cultural Beliefs are some indicators postulated to determine the disaster communication practices. Disaster communication practices is pretty much on the high side with an average mean of 3.10 on a five point scale means that disaster communication practices is very much okay in disaster prevention agencies in Nigeria. Perceived ease of use and usefulness of artificial intelligence applications were at an average level of 2.63 and 2.95 respectively. This means that perceived ease of use and usefulness of artificial intelligence applications used in disaster control in disaster prevention agencies in Nigeria are just at the average level. From a hypothetical point of view, perceived ease of use had a low relationship with disaster communication practices (25%) but a significant influence on disaster communication practices ( $p < 0.05$ ). Usefulness of artificial intelligence application had a 51.3% relationship with disaster communication practices but recorded a positive significant influence on disaster communication practices ( $p > 0.05$ ). Multiple regression wise, both independent variables were pretty much significant to disaster communication practices but both recorded a relationship of 57%.

This research work employed the descriptive survey research design. It sampled 93 out of a total number of 102 employees in disaster prevention agencies in Nigeria. The key instrument for data collection was a planned questionnaire. The instrument was validated using Cronbach's alpha test and the value of 0.75 and above was measured adequately for this research work. Data

analysis was a combination of both descriptive and inferential statistics such as percentage distribution, mean and standard deviation as well as regression analysis. The major findings of the study were as follows:

1. Disaster communication practices in disaster prevention agencies in Nigeria was at a level of 3.10 on a five point scale. This is well above average which means disaster communication practices in these agencies is very much okay.
2. Perceived ease of use of artificial intelligence applications was at a level of 2.63 on a five point scale. This means that employees in disaster prevention agencies in Nigeria feel that the ease of use artificial intelligence applications used in preventing disasters in Nigeria is just averagely easy for them to use.
3. Usefulness of artificial intelligence applications to prevent disasters in Nigeria attracted a 2.95 mean score on a five point scale. This implies that usefulness of artificial intelligence applications by employees in disaster prevention agencies in Nigeria feel that these applications are just a little bit useful.
4. Perceived ease of use of artificial intelligence applications was positively significant ( $p < 0.05$ ) to disaster communication practices.
5. Usefulness of artificial intelligence applications was also was positively significant ( $p < 0.05$ ) to disaster communication practices.
6. Combined variables of perceived ease of use of artificial intelligence applications and usefulness of artificial intelligence applications was jointly significant ( $p < 0.05$ ) to disaster communication practices.

7. Perceived ease of use of artificial intelligence application has a 25% linear relationship with disaster communication practices. This means that perceived ease of use of artificial intelligence application in the Nigerian context is positively not too strong.
8. 8. Usefulness of artificial intelligence applications has a 51.3% linear relationship with disaster communication practices. This means that usefulness of artificial intelligence applications has a strong positive relationship with disaster communication practices.
- 9.
9. Both perceived ease of use and usefulness of artificial intelligence applications from a combined perspective interestingly recorded just a 57% relationship. This also implies a positive strong relationship statistically. But for the fact that two combined variables on dependent variable in the Nigerian context is not too good.

## **5.2 Conclusion**

The study has thrived in investigating the influence of perceived ease of use and usefulness of artificial intelligence applications on disaster communication practices. The study has proved that perceived ease of use can actually prevent disasters likewise usefulness of artificial intelligence applications. The study has confirmed the fact that perceived ease of use of artificial intelligence applications if it is utilised well can actually have a good relationship with disaster communication practices as well as usefulness with artificial intelligence applications.

## **5.3 Recommendations**

Grounded on the conclusions that were discovered in this research, the following recommendations are hereby extended as the way forward.

1. The Federal Government of Nigeria has got to introduce much training programs for employees in her disaster prevention agencies. Basically to know how to use effectively artificial intelligence applications to combat disasters in the country. This is based on the fact that the response from employees as regards perceived ease of use on artificial intelligence applications gathered a mean score of 2.63 on a five point scale.
2. Since usefulness of artificial intelligence applications attracted a mean score of 2.93 on a five point scale, then this study is recommending that the Federal Government of Nigeria should purchase more useful applications that can be handled by staffs of disaster prevention agencies to combat and prevent disasters in the country.
3. Perceived ease of use and usefulness of artificial intelligence applications from a combined perspective recorded a 57% relationship based on one of the findings of this study, therefore, this study recommends that if the Federal Government of Nigeria can carry out adequate trainings on the use of artificial intelligence applications, there will be much ease of use of these applications by employees in disaster prevention agencies in Nigeria.
4. Perceived ease of use and usefulness of artificial intelligence applications both recorded a positive significant influence on disaster communication practices in this study. On this basis, the study is recommending that since different forms of disaster do happen in Nigeria, then the Federal Government of Nigeria should specially request for artificial intelligence applications from manufacturers of these equipment to combat and prevent the occurrence of disasters in Nigeria.

5. Finally, this study recommends that the Federal Government of Nigeria should hire artificial intelligence application developers to come to the country, study the nature of our disasters and develop applications that can solve our disaster crisis.

#### **5.4 Contribution to Knowledge**

The significance of the discoveries of this study recognized the link between perceived ease of use and usefulness of artificial intelligence applications on disaster communication practices. The study delivers thorough evidence on those modules of disaster communication practices, perceived ease of use and usefulness. The conclusions of this study established the shortage of research in examining the influence of perceived ease of use and usefulness of artificial intelligence applications on disaster communication practices. Consequently, this study has produced a stage through which the occurred gap has been completed and a foundation through which forthcoming investigation could be grounded.

#### **5.5 Area of Further Studies**

The study offers pragmatic indication for the influence of perceived ease of use and usefulness of artificial intelligence applications on disaster communication practices in disaster-prevention agencies in Nigeria. The following suggestion for further studies is mentioned below by which other scholars can look into.

1. Efficacy of artificial intelligence applications to detect likely disasters in Nigeria.
2. Role of Robotics in detecting and preventing disasters in Nigeria.

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## **APPENDIX 1**

### **RESEARCH INSTRUMENT**

#### **QUESTIONNAIRE ON PERCEIVED EASE OF USE AND PERCEIVED USEFULNESS OF ARTIFICIAL INTELLIGENCE (AI) ON DISASTER COMMUNICATION PRACTICES IN NIGERIA (PEUPUAI)**

Dear Respondent,

This Questionnaire is aimed at eliciting your response for the purpose of data collection for an on-going PhD research work. Below are questions related to the use of Artificial Intelligence in your organization, the perceived ease of use and the perceived usefulness of AI in your organization. Also, there are items on Disaster Communication Practices which is to enable the researcher know the level of awareness and sensitization of disaster in and through your organization. Please you are required to provide answers to the questions, while honest and candid opinion would be appreciated. Your response will be used for research purposes only and confidentiality is guaranteed. Thanks.

Yours faithfully,

**GLORIA ONYINYECHI CHIGBU**

Department of Mass Communication,

Lead City University, Ibadan, Oyo State.

## SECTION A: DEMOGRAPHIC INFORMATION

1. Name of Organization: \_\_\_\_\_
2. Gender: Male [ ] Female: [ ]
3. Age:
  - 20-30 [ ]
  - 31-40 [ ]
  - 41-50 [ ]
  - 51 – 60 [ ]
  - 60 and above [ ]
4. Educational Qualification:
  - HND [ ]
  - B.A [ ]
  - B.Sc [ ]
  - Masters Degree [ ]
  - PhD [ ]
5. Professional Qualifications:
  - CIS [ ]
  - ICAN [ ]
  - CIBN [ ]
  - Others \_\_\_\_\_
6. For how long has your company been in managing disasters?
  - 5 – 10 years [ ]
  - 11 – 20 years [ ]
  - 21 – 30 years [ ]
  - 30 years and above [ ]
7. Position at work:
  - Manager [ ]
  - Supervisor [ ]
  - Programme Director [ ]
  - Others \_\_\_\_\_

**SECTION B: DISASTER COMMUNICATION PRACTICES**

Please identify your level of agreement with the following statements on the information culture of your organization by ticking the appropriate response of each statement.

(SA= Strongly Agree, A = Agree, D=Disagree, SD=Strongly Disagree and Undecided)

S/N	Disaster Communication Practices	SA	A	D	SDA	U
	<b>Trust Worthiness of Communication</b>					
	There is trust in the level of communication received					
	The dissemination of valid information brings about trust in communication					
	<b>Access to Social Media</b>					
	Through Social media, we receive emergency information					
	The use of social media brings about fast way to approaching, and implementing necessary measures.					
	In our firm, we use social media to access possible solutions to disasters.					
	<b>Reliability of Communication</b>					
	Reliability of communication makes us approach disaster management at the right time.					
	Genuine information received makes our communication reliable.					
	<b>Social Capital</b>					
	I perceived that trust is a key of social capital undercurrents in disaster situations					
	I think the social capital of communities experiencing disasters can help in promoting trust and community involvement in					

	communication					
	<b>Cultural beliefs</b>					
	The knowledge about cultural dynamics helps to promote social resilience in the face of disasters.					
	It is important to understand the socio-cultural worldviews and behaviours of people in the management of disasters.					

### SECTION C: PERCEIVED EASE OF USE OF ARTIFICIAL INTELLIGENCE

Please identify your level of agreement with the following statements on the transformational and transactional leadership styles of your organization by ticking the appropriate response of each statement.

(SA= Strongly Agree, A = Agree, D=Disagree, SD=Strongly Disagree and Undecided)

S/N	Perceived Ease of Use of AI	SA	A	D	SD	U
	<b>Stress Free Interaction</b>					
1.	I enjoy stress-free interaction in using AI					
2.	I noticed some people in my organization using AI encounter stress					
	<b>Less error made</b>					
4.	When I use AI for any of the task, there is lesser error made					
5.	Even when I am not used to AI, I make little or no mistakes					
	<b>Easy handling of AI</b>					
7.	I personally enjoy it when I use AI					

8.	My knowledge about the use of AI makes it so easy for me to use					
9.	My colleagues find it difficult when handling AI for an task					
	<b>Easy Familiarization</b>					
11	I get familiar with AI as a matter of continuous use					
12	My familiarization with AI is due to the knowledge or training I went through					

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**SECTION D: PERCEIVED USEFULNESS OF ARTIFICIAL INTELLIGENCE**

Please identify your level of agreement with the following statements on the employee trust of your Firm by ticking the appropriate response of each statement.

**(SA= Strongly Agree, A = Agree, D=Disagree, SD=Strongly Disagree and Undecided)**

S/N	Perceived Usefulness of AI	SA	A	D	SDA	U
	<b>System Performance</b>					
	I perceived that the use of AI aids our system performance					
	The use of AI increases the rate of our system performance					
	<b>Job Support</b>					
	AI supports staffs’ task					
	AI aids the job support in my firm					
	The use of AI does not support work performance in other departments and firms					
	<b>Increased Productivity</b>					
	Our organization solely depends on AI, hence increased productivity					
	I perceived the use of AI increases not only our staffs’ productivity but the organization as a whole.					
	<b>Task Accomplishment</b>					
	I am always happy using AI for any task as it aids in perfecting my work with little stress					
	AI compared to former ways of executing task has shown great impact of accomplishment					
	I prefer the use of AI to mechanical way in executing task because AI performs task faster and with little or no errors					

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