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Effective Humanitarian Information Systems

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Effective Humanitarian Information Systems

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ABSTRACT

Humanitarian Information Systems (HIS) are of great importance in crisis times because relief organizations need accurate and timely information to respond and meet the affected population's needs. The more relief organizations can collect, process, analyze, and disseminate information, the more effective the response will be. Humanitarian organizations worldwide rely on Information and Communication Technology (ICT) for communication, coordination, and decision-making regarding distributing reliefs to the affected people. This study highlights some of the challenges of information systems in humanitarian work. It provides a guide that may assist humanitarian relief organizations in managing their information systems in a way that enables them to respond to crises better.

1. Introduction

Disasters and crises have left nearly 168 million people in need of humanitarian aid worldwide, and they are still rising.[1] Providing appropriate and timely assistance to those vulnerable people has been a challenging task for humanitarian organizations. Flows of information in response to the humanitarian needs in emergencies play a significant role in the operations of all organizations and agencies engaged in humanitarian response and enables donors and recipients to share relief data. In disaster situations, information is critical for decision-making and essential for quick and practical support. Despite the vital role in aid operations, information can also be a real threat to people's lives if insufficient, false, or even abused by cybercriminals.

Information systems must support information flows and enhance different emergency and disaster management work processes; perfect information management directly results in livelihood improvement for vulnerable communities. Disasters usually cause severe difficulties and damage to infrastructure, geographic challenges, and time pressures, so humanitarian organizations working in such circumstances must have feasible response methodologies besides Information and Communication Technology (ICT) for their essential role in aid operations.

Previous research has demonstrated observed gaps regarding the optimal application and exploitation of Humanitarian Information Systems (HIS).[2] These gaps relate to the generation, analysis, and circulation of information before, during, and after disaster situations, mainly due to the humanitarian organizations' exceptional and complicated working conditions that affect their

[1] United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA). (2019). *A record number of people will need help worldwide during 2020: UN Humanitarian Overview*. https://news.un.org/en/story/2019/12/1052731

[2] Altay, N., & Labonte, M. (2014). *Challenges in humanitarian information management and exchange: evidence from Haiti*. S4.

systems. "In complex systems, patterns of interaction are characterized by dynamism and are highly sensitive to initial prevailing conditions."[3]

Information systems professionals in the global humanitarian community usually make progressive efforts to formulate digital aid principles, protocols, and frameworks to strengthen information and help for effective humanitarian action. There is a need for a better understanding of information systems in humanitarian work, and this study represents a method to bridge the gap for an effective HIS.

[3] Altay, N., & Labonte, M. (2014). *Challenges in humanitarian information management and exchange: evidence from Haiti*. S4.

2. Information in Crises Situations

To better understand the role of the information systems in humanitarian work, it is essential to understand their context. Humanitarian aid aims to reduce suffering and harm and save lives by providing help and crucial needs during crises of all kinds. Generally, there are two types of disasters, natural disasters such as floods, hurricanes, earthquakes, etc., and human-made disasters, such as building fires, explosions, armed conflicts, etc.[4] Disasters generally cause confusion, and reliable information may not be readily available in the early hours. As shown in Figure 1, usually, there are four main channels of interaction between crisis respondents during emergencies: within those affected, from those affected to humanitarian organizations, from humanitarian organizations to those affected, within or among the humanitarian organizations.[5]

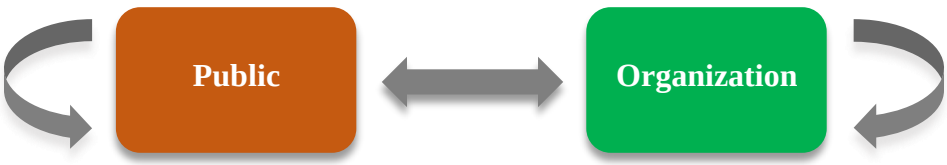

Figure 1: Interaction between crises respondents

According to some studies,[6] the importance of reliable information in humanitarian interventions is heightened as the number of people affected by humanitarian crises has almost doubled over the past decade and is expected to keep rising. Reliable information, which is complete, timely, and without errors, tends to be a premium given the context of uncertainty coupled with the need for swift reporting and response. The absence of reliable information to

[4] Mukhopadhyay, B. & Bhattacherjee, B. (2015). *Use of information technology in emergency and disaster management. American Journal of Environmental Protection*. http://article.sciencepublishinggroup.com/html/10.11648.j.ajep.20150402.15.html

[5] Sagun, A., Bouchlaghem, D. & Anumba, C.J. (2009). *A Scenario-based Study on Information Flow and Collaboration Patterns in Disaster Management*. 33(2), 38–214.

[6] Vila-Pozo, M. & Sahay, S (2018). *Humanitarian Health Information Systems: Different Challenges and Responses*. University of Oslo, Norway. 2.

address challenges arising through the unstable and fast-changing environment of humanitarian interventions could potentially result in wrong decisions and slow reactions that could adversely impact people's lives. We must bear in mind that information management in disaster conditions and relief operations is entirely different from information management in business environments due to urgent responses.[7] As shown in Figure 2, during relief operations; information flows are closely related to data collection (recording of affected people and accidents), processing (compiling data into databases for knowledge management and resource allocation decisions), analysis (in an emergency, analysis usually limited to summarizing information and prioritizing and testing assumptions), and dissemination (across a range of technologies, systems, and structures). When organizations can manage these processes effectively, they can build explicit knowledge and form insight about the crisis that enables them to make decisions regarding resource and aid flows.[8]

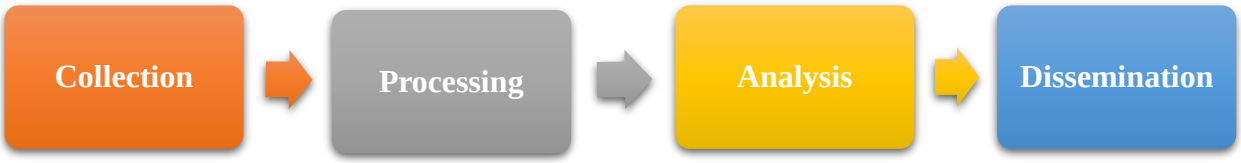

Figure 2: Information flows within aid organizations

In emergencies, information becomes the basis for guiding those affected and references for public opinion in general. Depending on the crisis level and its associated complications, relief organizations often include an individual or work team with experience in information management, mainly collecting, processing, analyzing, and disseminating information and issuing

[7] Mubaraka, C., Kalulu, R. & Salisu, M. (2013). *Information Technology and Humanitarian Emergency Response Management in WFP Uganda*. Global Journal of Commerce & Management Perspective, Kampala, Uganda.
[8] Day, J.M., Junglas, I. & Silva, L. (2009). *Information Flow Impediments in Disaster Relief Supply Chains*. Journal of the Association for Information Systems. 10(8), 60–637.

reports for the fieldwork teams and media.[9] The list of tasks that the information management team carries out includes a set of responsibilities, most notably the following:

- Receive, collect, and update information and statistics about crisis, whether from fieldwork teams or other organizations.
- Prepare crisis reports, work plans, and technical documents for internal and external use.
- Produce, promote, and facilitate resources such as maps, drawings, photos, videos, etc., that document the damage and impacts resulting from humanitarian organizations' disaster and response actions.
- Direct follow-up of media coverage of the effects resulting from the disaster and the volume of response on the part of relief organizations and provide recommendations regarding aid to those affected and only available data and information.
- Develop and update communication and information exchange plans in emergencies.
- Provide advice to authorities and partners in crisis management to develop databases, manage information and communication activities to better respond to emergencies, and protect people effectively.

During a disaster strikes, the information management team's efforts are focused mainly on gathering information and preparing reports, which are the main drivers of fieldwork teams. In some crises, the information management team may face significant difficulties accessing, organizing, and disseminating information; therefore, the best way to deal with such situations is to anticipate and prepare for them.

[9] Barrantes, SA., RodrIguez M. & Pérez, R. (2009). *Information Management and Communication in Emergencies and Disasters*. Pan American Health Organization, Washington, D.C., United States. 3, 40–58.

3. Humanitarian Information Systems (HIS)

The Humanitarian Information Systems (HIS) concept involves the information technology and the interacting people, practices, policies, and organizational environments sector.[10] HIS facilitate information flow in complex humanitarian operations such as transportation, supply chain management, monitoring and evaluation, and relief distribution.[11] The HIS made significant humanitarian work changes and helped enhance the speed, quality and quantity of processed and published information. It allowed more control and coordination between organizations, especially after the global spread of mobile technology and access to the web.

Usually, coordination between humanitarian organizations is challenging and problematic; however, humanitarian organizations have benefited from the advantages and flexibility of using notebooks, laptops, mobile phones, social media, and communication capabilities via satellite and Global Positioning Systems (GPS). The use of Information & Communication Technology (ICT) and its humanitarian applications have been implemented gradually and evolutionarily using a hybrid approach to strategic planning and experimental learning because of the significant differences in the conditions technology and applications have normally used, and the work conditions in crisis areas.

Shifting from the experimental nature to entirely relying on ICT in crisis management and humanitarian operations makes considerable progress in managing and sharing information within the human community. It helps create a spirit of cooperation and participation, build trust between organizations, and facilitate their mission.[12] Geographic Information Systems (GIS) technology,

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[10] Maiers, C., Reynolds, M. & Haselkorn, M. (2005). *Challenges to Effective Information and Communication Systems in Humanitarian Relief Organizations*. IEEE International Professional Communication Conference Proceedings. 83–89.

[11] Tusiime, E. & Byrne, E. (2011). *Information Systems Innovation in the Humanitarian Sector*. World Food Program (WFP), Khartoum, Sudan and Royal College of Surgeons in Ireland, Dublin, Ireland. 36.

[12] Sargent, J. & Michael, K. (2005*). The Need for a Digital Aid Framework in Humanitarian Relief*. The 9th World Multi-Conference on Systemics, Cybernetics and Informatics (WMSCI 2005), Orlando, Florida, United States. 6–9.

in particular, has had a substantial impact on publishing geographical information and maps, especially as humanitarian organizations usually face severe difficulties in disaster areas, such as infrastructure damage and geographical challenges. The GIS provides a mechanism to centralize and display important information during an emergency. Divergent technological solutions based on GIS have become an integral part of disaster management in developed and developing countries.[13]

The Internet's adoption as a means of electronic communication and information exchange corresponded with many intranets and websites that aid organizations have developed as repositories of information. There is no doubt that the availability and use of the Internet have opened the door wide for new possibilities for cooperation between humanitarian organizations and their partners worldwide, in addition to searching for information, planning, and direct follow-up of relief operations.

All these make the HIS role increase and grow day by day in crisis situations and change how humanitarian aid is organized and implemented. The digital revolution, the Internet, and the great advances in ICT have helped relief organizations access and exchange information, communicate in real-time remotely with field teams, and comprehensively plan and coordinate relief intervention tasks. In turn, this led to a sweeping change and a qualitative shift in the traditional relief activities and operations.[14] HIS builds relationships between actors in society and organizations in the field and significantly impact financial flows and support. It provides new ways to address the

[13] Ortiz, D. (2020). *Geographic Information Systems (GIS) in Humanitarian Assistance: A Meta-Analysis*. Florida International University, United States. 3–5.
[14] Sargent, J. & Michael, K. (2005*). The Need for a Digital Aid Framework in Humanitarian Relief*. The 9th World Multi-Conference on Systemics, Cybernetics and Informatics (WMSCI 2005), Orlando, Florida, United States. 6–9.

humanitarian financing gap and provides opportunities for everyone at the local community level to participate in relief operations.[15]

4. Challenges of HIS

HIS's role is not only to support aid delivery to those affected, but it must also support the considerably complex organizational communications between all the influential actors in disaster management and those who have suffered during the crisis.[16] A preliminary literature review shows that past research focuses mainly on the challenges of managing information in coordinating humanitarian relief. When dealing with emergencies and disasters, communication planning becomes a complex and challenging task; it involves collecting, organizing, producing, and disseminating the information that allows to make decisions and mobilize necessary resources. Humanitarian emergencies have increased globally during the past two decades due to wars and conflicts, especially in developing countries, and natural disasters worldwide. These emergencies have led to the continuation of humanitarian relief budgets and the escalation of the growth in the size and number of aid organizations, whether governmental and non-governmental agencies. The working conditions of humanitarian organizations in disaster situations often negatively affect information flow, and overcoming these difficulties becomes more complicated during the later stages of the disaster response cycle.17 The following are the highlights of these challenges:

[15] European Parliamentary Research Service (EPRS). (2019). *Technological innovation for humanitarian aid and assistance*. Brussels, European Union. 11.
[16] Maiers, C., Reynolds, M. & Haselkorn, M. (2005). *Challenges to Effective Information and Communication Systems in Humanitarian Relief Organizations*. IEEE International Professional Communication Conference Proceedings. 83–89.
[17] Day, J.M., Junglas, I. & Silva, L. (2009). *Information Flow Impediments in Disaster Relief Supply Chains*. Journal of the Association for Information Systems. 10(8), 60–637.

4.1 Decentralized Organizational Structure

The working nature of humanitarian organizations, especially in developing countries, requires adopting a decentralized organizational structure that allows for a high degree of independence for sub and field offices, with minimal oversight by the headquarter. What distinguishes this organizational structure is that field offices help accurately understand the local situation and needs in the country and crisis area.[18] This helps humanitarian organizations respond more quickly to disasters; nevertheless, the decentralized structure causes significant tensions and complications regarding the management and implementation of the HIS infrastructure.

For example, workers in the field offices in poor environments may choose unique local systems depending on the budget and availability, while the headquarter use other systems. The use of incompatible systems and separate applications, or even not using it, sometimes makes communication and coordination between branches and headquarter very complicated. There is a need to adopt a central organizational strategy concerning HIS; nevertheless, attention and follow-up from headquarter to implement such a strategy is usually ineffective and not a priority. Also, field offices are seldom worried about implementing headquarters recommendations in this regard.

4.2 Lack of Funding

Donors and humanitarian aid organizations generally view HIS as a supplementary activity, not a core activity. They have always focused on urgent cases and channeled funds toward immediate solutions such as providing water, food, shelter, and medicine directly to the visible relief needs. Even consider the HIS costs a financial burden, so the overhead costs are kept to a

[18] Maiers, C., Reynolds, M. & Haselkorn M. (2005). *Challenges to Effective Information and Communication Systems in Humanitarian Relief Organizations*. IEEE International Professional Communication Conference Proceedings. 83–89.

minimum. What makes matters worse is that most of the funding relies on relatively short-term projects, which provide few resources to meet long-term HIS infrastructure needs. Providing adequate ICT funding is a common problem in humanitarian organizations and makes it very difficult for organizations to invest in HIS's strategic infrastructure adequately.[19] This imposes a reactionary situation for humanitarian organizations in which the HIS needs cannot be sufficiently and quickly addressed.

4.3 Lack of Trained Staff

There is no doubt that the optimal application of information systems in humanitarian work is hampered by the critical shortage of skilled workers, especially in developing countries, and their ability to interact with information sources online and outside. Many do not know how to deal with ICTs and sometimes are reluctant to accept new technologies in their work. To ensure the HIS's effectiveness, there is a need to train field workers in relief and support staff in using ICT tools, applications, the Internet, and a variety of programs for the crisis phases.[20] Workforce and infrastructure in crisis areas still play a significant role in determining the level of use and integration of ICT, especially in war and armed conflict situations.

4.4 Weak Information Management

The ability of humanitarian organizations to store and manage information and knowledge is essential in responding to disasters effectively and necessary for lessons learned, performance evaluation, and future operations improvement. In the past, humanitarian organizations focused on

[19] Haselkorn, M. (2005). Improving humanitarian relief for the next big disaster, The Seattle Times, http://seattletimes.nwsource.com/html/opinion/2002150504_haselkorn14.html

[20] Sargent, J. & Michael, K. (2005). *The Need for a Digital Aid Framework in Humanitarian Relief*. The 9th World Multi-Conference on Systemics, Cybernetics and Informatics (WMSCI 2005), Orlando, Florida, United States. 6–9.

response activities, but now there is a growing interest in learning activities, which needs HIS development to track and capture past experiences. Nevertheless, information management does not find sufficient support and attention in the humanitarian sector for several reasons, including insufficient financial resources, lack of professional remuneration, multiple views on the importance and role of information systems infrastructures, and technology focus organizational culture.

4.5 Lack of Cooperation

Usually, a wide range of actors and stakeholders are affected by disasters and thus participate in the disaster management process. Various government sectors at the national, governmental, and local levels, foreign aid and relief organizations, non-governmental organizations, civil society, private sector bodies, volunteers, and groups of citizens may deal with disasters. In some cases, each agency or organization may have specific tasks, but these tasks and roles often overlap. In such situations, the importance of cooperation and information sharing between humanitarian organizations becomes evident. For example, a shared GIS data center could track the displacement and migration of the affected population. However, it is unfortunate that many organizations do not cooperate in this aspect and refrain from sharing information with others, especially information that is of great value to the operation due to the intense competition for funding sources from the same donors.[21]

[21] Maiers, C., Reynolds, M. & Haselkorn M. (2005). *Challenges to Effective Information and Communication Systems in Humanitarian Relief Organizations*. IEEE International Professional Communication Conference Proceedings. 83–89.

4.6 Need for Comprehensive Strategies

To avoid confusion and complications, organizations can implement HIS strategies that consider users' diverse conditions and meet the unique needs of communications at the field office level. However, many of the headquarters' HIS projects are usually developed and managed without consultation with field staff and offices. For example, many plans are issued from the organization's headquarters to enhance field activities, such as Supply Chain Management (SCM), whose implementation is based on ICT, but what is done in the field is very different from the headquarter perspective.[22] HIS strategies that do not involve field workers in their planning or consider their views often cause friction and tension between field staff and headquarter. This ultimately leads to poor implementation or abandonment of many-valued HIS applications due to a lack of adequate support from local offices during the design and development phases.

5. Building HIS Bridges

Humanitarian aid organizations are increasingly seeking to take advantage of technology's tremendous development and employ it in relief operations worldwide. Nevertheless, there is still an observed gap regarding collecting, analyzing, and sharing information before, during, and after crises because of working conditions and previously mentioned challenges.[23] To bridge this gap, this study represents:

1. Guideline on best practices and a better understanding of information systems in humanitarian work.

[22] Maiers, C., Reynolds, M. & Haselkorn, M. (2005). *Challenges to Effective Information and Communication Systems in Humanitarian Relief Organizations*. IEEE International Professional Communication Conference Proceedings. 83–89.
[23] Day, J.M., Junglas, I. & Silva, L. (2009). *Information Flow Impediments in Disaster Relief Supply Chains*. Journal of the Association for Information Systems. 10(8), 60–637.

2. Discovering novel ways to apply big data in humanitarian work. Figure 3

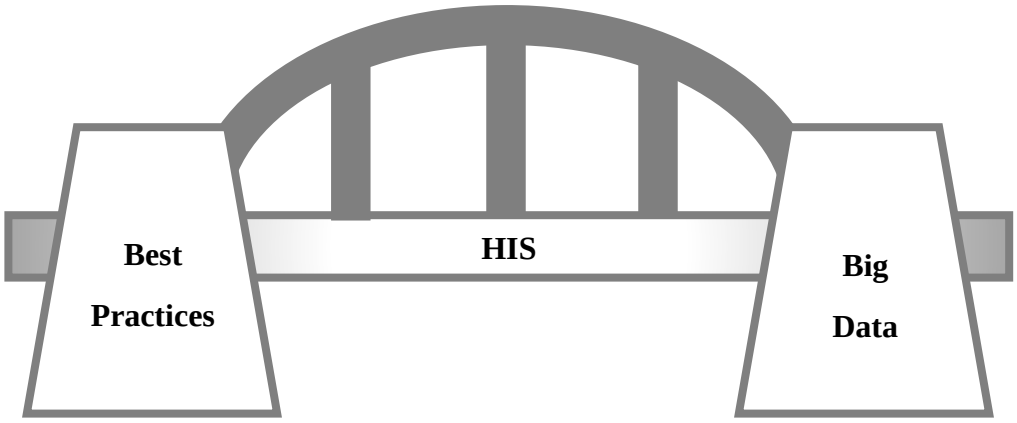

Figure 3: HIS bridge

5.1 Best Practices:

The HIS requires operating in all stages of the disaster management cycle with scalability and great diversity across the recovery and mitigation phases, managing the information flow from preparation to the response.[24] During this study, many common themes and best practices emerged from the exchange of experiences and lessons learned among the humanitarian HIS practitioners.

5.1.1 Enabling Environment

Planning for communication in emergencies at the national level should be continuous. Plans must be updated continuously, lessons learned from training and disaster response efforts applied, and multiple potential risks in HIS must be addressed. Investing in advanced installment equipment, mobile resource units, or temporary base stations in risk-prone areas will support crisis

[24] Howden, M. (2009). *How Humanitarian Logistics Information Systems Can Improve Humanitarian Supply Chains: A View from the Field*. Paper presented at the 6th International ISCRAM Conference, Gothenburg, Sweden. 3–5.

resilience and risk reduction.[25] Restrictive rules on import and export, licensing restrictions, and other issues may delay the delivery of equipment to the disaster area, hindering the ability of government agencies, non-governmental organizations, and private agencies to respond to disasters. Therefore, prepositioning can help alleviate these problems and ensure that equipment and other supplies are mobilized as soon as possible.

Regulatory and policy frameworks can either facilitate or hinder the deployment of ICTs during disasters, especially in developing countries. Authorities must review the rules and conduct an assessment to determine whether modifications or interim measures are necessary to facilitate rapid response to disasters, particularly in light of the accelerating development in technologies and applications, which may benefit from any review process to identify any obstacles.

To ensure the availability of much-needed ICT equipment, simplifying approval processes and licensing systems is critical. For example, during the approval process, it could be exempt from the performance of customs duties or visa requirements in emergency response scenarios or exempt from restrictions imposed on foreign operators or service providers. Concerning licensing, ICT equipment and satellite communication services may be exempt from licensing requirements during emergencies or provided with an expedited licensing procedure. Alternatively, some classes of licenses could be made available for temporary or emergency use.

5.1.2 HIS Awareness

HIS differ in several ways from business information systems and therefore requires its private system designs and theories. The exchange of information between the concerned authorities contributes to increasing situational awareness, reducing duplication, and directing response

[25] International Telecommunication Union (ITU). (2017). *Use telecommunications/ICTs for disaster preparedness, mitigation and response*. Telecommunication Development Bureau, Geneva, Switzerland. 13–20.

efforts more accurately. When disaster strikes, respondents providing ICTs need to quickly obtain information on their ICT networks' state to support continuity of communications or restore contacts. Adopting common approaches or standard terminology for outage reporting can facilitate global response efforts.

5.1.3 Development of Relationships

Building relationships and trust with internal and external stakeholders participating in response efforts will significantly facilitate information exchange and implementation efforts when disasters occur.[26] During a disaster, ICT for citizens turns from a mere luxury into an essential tool whose function is to receive and exchange information that saves lives and includes the restoration of economic activities. Priority should be given to restoring public telecommunications networks, bearing in mind the possibility of implementing temporary solutions that enable mobile connectivity.

5.1.4 Capacity Building

Staff training is essential in supporting disaster response plans and should cover all aspects, including HIS and ICT equipment use. Organizations should adopt training programs based on their employees' needs and knowledge, make them easy to understand and relevant to the context and work environment. Also, organizations should continue to integrate new and emerging technologies and applications in contingency planning and disaster response, including social networks, the Internet of things, GIS, remote sensing, and drones equipped with wireless communication solutions.

[26] International Telecommunication Union (ITU). (2017). *Use telecommunications/ICTs for disaster preparedness, mitigation and response*. Telecommunication Development Bureau, Geneva, Switzerland. 13–20.

5.2 Big Data in Crises Analytics

The rapid change and improvement in technology provide innovative digital solutions for many sectors, including the humanitarian sector. Perhaps one of the most important benefits of modern technology for the humanitarian sector is bridging the HIS gaps and providing vital resources quickly and efficiently in a shorter time and lowest cost. Usually, massive amounts of data arise during a disaster, including personal data, geolocation of roads, survivor tracking, and more. If this data is used effectively, it may provide important information that helps humanitarian organizations make immediate decision-making and prioritize and improve response efforts.[27]

Data is the lifeblood of the decision-making and raw material for accountability. In the private sector today, big data analysis has become similarly common, as is the process of consumer profiling and modeling services to suit individuals' personal needs and the use of predictive analytics in marketing, advertising, and management. Similar techniques can be adopted to obtain real-time insights into people's situations and be used to provide aid to vulnerable groups. New data sources, new technologies, and new analytical approaches can make decision-making more efficient and flexible. Data analytics can complement observations, official statistics, and questionnaire data. By integrating this new data with traditional data, it becomes possible to produce higher-quality, more detailed, and more relevant real-time information.

The private sector collects most of the big data of great importance for public interest and humanitarian work. It requires establishing partnerships between the public and private sectors to benefit from this data. There are many sources of big data that can be relied upon to provide data that help in crisis analyzes, including the following:

[27] Yoo, T. (2018). 4 ways technology can help us respond to disasters. https://www.weforum.org/agenda/2018/01/4-ways-technology-can-play-a-critical-role-in-disaster-response/

5.2.1 Online Data:

Online data includes data that users create on the Internet for all types of social activities (such as SMS messages, emails, blogs, and comments), social media (such as Facebook posts/comments, and Twitter tweets), and search engines activities (such as Google), and so on. What distinguishes online data is that it is often publicly available, making it easy to analyze crises.

In December 2011, the Philippine government used Facebook to warn people of impending floods. Since then, the Digital Humanitarian Network (DHN) has been established by the United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA) in December 2012 and activated five times in South Sudan, the Philippines, Syria, Samoa, and the Democratic Republic of the Congo to facilitate crisis mapping, improve speed and accuracy of the information for respondents, and reduce data collection costs. In South Sudan, the team collected more than 15,000 data related to displacement, returnees, security, and other issues. In the Democratic Republic of the Congo, the team mapped and prepared population censuses for more than 250 regions, and in the Philippines, searched more than 20,000 social media messages.[28]

5.2.2 Sensors Data:

Sensing technology provides valuable and necessary data regarding weather forecasts, predicting climate change, and monitoring social behavior. Measurements or observations on the ground are timely and more accurate than similar observations from space. Sensing data is primarily public, and improvements in open mapping technologies are helping in access to it. There is no doubt that the availability of sensor data and its analysis greatly helps in providing

[28] MacLean, D. (2013). *Potential, pitfalls of "big data" for humanitarians*. The New Humanitarian. https://www.thenewhumanitarian.org/analysis/2013/05/27/potential-pitfalls-big-data-humanitarians

information for warning and warning about disasters and planning relief operations, in addition to assessing damage and monitoring disaster recovery.

NASA's applied disasters program promotes Earth observations to improve the prediction of preparation for, response to, and recovery from natural and technological disasters. The program is supported by NASA scientists representing many data products relevant to natural hazards, including floods, earthquakes, volcanoes, and landslides. The program ensures a robust connection between the researchers involved in developing hazard-relevant products and the end-users who could benefit from them.

Disaster applications and applied research on natural hazards support emergency preparedness leaders in developing mitigation approaches, such as early warning systems and providing information and maps to aid and recovery teams. Explore maps and data at the Disasters Mapping Portal. For example, NASA's Disaster in Applied Sciences Program encourages the use of Earth observation to improve forecasting and preparedness for natural and technological disasters. The existence program supports building relationships between researchers involved in developing risk-related products and end-users who can benefit from them, such as disaster risk managers, humanitarian response organizations, public health professionals, journalists, and others who need maps, data, and rapid assessments of populations potentially exposed to a major risk event or emergency.[29]

[29] National Aeronautics and Space Administration (NASA). (2020). *Disasters Data Pathfinder*. https://earthdata.nasa.gov/learn/pathfinders/disasters

5.2.3 Public Data:

Much of the public data collected by government institutions can be of great value if analyzed in the event of a crisis. It includes census data, personal, health, social and economic data, etc. The significant progress in information technology has led to the development of general data collection tools and the shift from using paper-based means to digital means, facilitating access to and analyzing that data. Although public data is not always generally accessible, many governments are steadily adopting the trend of open data to enhance transparency and so forth. Such initiatives can be used to analyze data that improve decision-making in emergencies and humanitarian action. For example, American Community Survey statistics help identify counties with significant at-risk populations such as the elderly. Also, the Census Bureau's ongoing surveys of businesses will help measure the economic impact of emergencies and help in the country's eventual recovery.[30]

5.3 Risks of Big Data in Crises Analytics

Human rights must be protected to realize the opportunities offered by big data in humanitarian work. Privacy, ethics, and respect for data sovereignty require thoroughly assessing individuals' rights while considering the benefits to the group. Most of the new data is collected passively - meaning it is captured from digital waste that people leave behind; or through inferences that use algorithms. And because big data is the product of unique patterns of individual behavior, removing explicit personal information may not fully protect privacy. Thus, the combination of

[30] America Count Staff. (2020). *From COVID-19 to Hurricanes, Census Surveys Help Areas Prepare and Recover*. United States Census Bureau. https://www.census.gov/library/stories/2020/04/how-census-data-help-the-nation-respond-to-disasters.html

several data sets can lead to identifying individuals or groups, exposing them to potential dangers. Hence, proper data protection measures must be put in place to prevent misuse of data.[31]

There are also risks of growing inequality and bias. Indeed, there are gaps between those who own the data and those who do not. Without appropriate action, a new front of inequality may open, dividing the world in half between those who know and those who do not. Many people are excluded from what is happening in the new world of data and information due to language barriers, poverty, ignorance, absence of technological infrastructure, geographic distance, or discrimination. A wide range of actions needs to be taken, including building all countries' capacities, incredibly the least developed and developing countries.

6. Conclusion

The use of technology to support humanitarian operations is a promising field; while several studies have appeared on HIS, there is still a lack of systematic overview in this field. Given the importance of disaster preparedness, the outcome of the question could focus on implementation and ways to enable the world to benefit from the wealth of information available to date on using technology in disaster situations. More time could be devoted to sharing experiences between humanitarian organizations, identifying common challenges and successful practices, and supporting the development and implementation of emergency HIS frameworks, technologies, and plans. Making better use of technology in humanitarian work can improve complex relief operations' effectiveness and efficiency and enhance reliability and responsiveness.

[31] United Nations (UN) (2017). *Big Data for Sustainable Development*. https://www.un.org/ar/sections/issues-depth/big-data-sustainable-development/

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America Count Staff. (2020). *From COVID-19 to Hurricanes, Census Surveys Help Areas Prepare and Recover*. United States Census Bureau. https://www.census.gov/library/stories/2020/04/how-census-data-help-the-nation-respond-to-disasters.html

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