

Understanding and Building the Definition for Infostructure in Disaster Management

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Abstract—‘Infostructure’ is a new term that has been used across many disciplines and carries different meaning. This diversity leads to the blurring of the limits of infostructure of how it can be applied to suit a specific discipline. Varying definitions exists, and this paper aims to build a definition of infostructure that can be applied for disaster, specifically in the research of disaster management. In this paper, existing definitions of infostructure from various disciplines are analyzed to extract common elements and to establish the basic characteristics of how infostructure can be applied into disaster. Based on these existing definitions, this paper presents definition for infostructure for use in disaster.

Index Terms—information sharing, disaster management, coordination

I. INTRODUCTION

The term infostructure is commonly used to describe the infrastructure of information that is used in multiple disciplines. As indicated by Hicks [1], the term infostructure is a part of IS (information systems) infrastructure that may include the use of it in a range of functional elements of any IS infrastructure and their integration. By taking this definition, the term infostructure can be applied in multiple disciplines that are using information systems in managing their information. However, this means that infostructure can be adapted to any areas that require an infrastructure to deals with information. The adaptability of Infostructure allows it to be an effective and powerful practice, but makes it difficult to be defined and categorized.

Infostructure has been cited in many different areas, with works like Chan *et al.* [2], the term infostructure is used to describe the combination of information content and ICT (information communication and technologies) infrastructure in forming an e-government infostructure; Johnston’s, in which he defined infostructure as a part of the relationship between information infrastructure and telecommunications in supporting e-commerce [3] or Arnborg [4] in which he made a general definition of

infostructure as a network centric model that is essential is maintaining a common model of battle space. There is no standard, agreed definition; instead there are varieties of definitions, which look at infostructure from different areas, including health, telecommunication and military.

II. BACKGROUND OF INFOSTRUCTURE

Based on the various definitions of infostructure found from the study conducted, it can be observed that most of the definitions focus on the element of information communication and technology (ICT) which is supported by other elements such as policies and regulation in providing e-services or telecommunications to organizations [2], [5]-[8]. Mori [5] has indicated that an infostructure comprises of data formats and protocols that are needed for integrations of different applications used in communication, while Uddin *et al.* [8] defines infostructure as various format of information that are essential for communication. In the other hand, looking at definition by Hanna [6], infostructure was defined as the combination of technical elements and policies in providing telecommunications to various stakeholders in the environment, similarly with Scott and Mars [7] that defines infostructure as combination of several elements in providing response to the affected parties.

However, this research feels that there are some gaps in the current definition of infostructure available in the literature. The definition of infostructure from the literature came from various disciplines, and there is no standard, agreed definition. As this research is looking into the discipline of disaster management, very little is known about how an infostructure looks or should be used for disaster management. Therefore, this research aims to define a direct and fit definition for infostructure, tailored for disaster management.

The objective of this article is to form a suitable definition to describe infostructure that is focused specifically for disaster. In order to obtain this definition, existing definitions and usage of infostructure will be analyzed. This definition will allows us to identify elements to fulfil infostructure tailored to disaster.

III. METHODOLOGY

A. Gathering Definitions and Filtering

The first stage in obtaining the definition was to collect as many definitions as possible of the word “infrastructure”. This process is important in finding the usage of the word over time and across disciplines. The definitions were gathered through a literature review of articles on infrastructure, focused on the usage of the word in area of disaster, using online databases, journals and books. Based on the research conducted, some definitions were often found to be focused specifically on several research areas such as healthcare and technology. In general, most of the articles found refer to definitions of infrastructure as an ICT infrastructure that deals with plethora of information.

Ultimately some 28 definitions of infrastructure were collected from various disciplinary literatures, as shown in the following table. Table I presents the authors, the year and the discipline of the gathered definitions. Full citations of each of these papers are listed in the references at the end of the article.

Five databases were selected and specific search criteria were established in setting up an initial repository. The repository is expanded to include documents that reference the most cited author. For the filtering of documents, only those that include technical infrastructure are selected. This search was conducted between November 2013 and February 2014.

TABLE I. LIST OF SOURCES OF DEFINITION CATEGORIZED BY DISCIPLINES

<i>Healthcare</i>	<i>Social Sciences</i>	<i>Information Technology / Computer Science</i>
(Scott, 2013)	(Garfield and Watson, 1998)	(Hanna, 2010)
(Noseworthy, 2004)	(Malek, 2009)	(Chan et al. , 2008)
(Aanestad and Jensen, 2011)	(Hartman and Winkler, 2013)	(Blanning et al. , 1997)
(Tsiknakis, 2002)	(Shapira et al. , 2006)	(Johnston, 1998)
		(Hicks, 2010)
		(Pohl, 2004)
<i>Engineering</i>	<i>Business and Management</i>	
(Uddin et al. 2003)	(Wallace and Choi, 1997)	(Arnborg et al. , 2003)
(Wolfram and Vogel, 2012)		(Raza Abidi and Yusof, 1998)
(Assaf, 2008)		(Shamala et al. , 2013)
(Wong, 1999)		(Ciborra and Hanseth, 1998)
		<i>Information Technology / Computer Science</i>
		(Hanseth et al. , 1996)
		(Losee, 1997)
		(Shin and Kweon, 2011)
		(Strader et al. 1998)
		(Stock et al. 2012)

IV. FINDINGS AND DISCUSSION

This section described the results obtained from the previous stages; the information sources consulted; document filter criteria and proposed definition.

A. Gathering Definitions and Filtering of Documents

Six databases are consulted in searching for the information, which includes–ACM, IEEE, ScienceDirect, SAGE, SpringerLink and Emerald. The term ‘infrastructure’ is used as the search criteria for all six databases. This search resulted in 170 documents across multiple disciplines as shown in Table II.

Based on the search results, the following are the results for infrastructure according to disciplines:

- Healthcare: 74 definitions
- Information technology: 93 definitions
- Social sciences: 47 definitions
- Engineering: 31 definitions
- Business and management: 2 definitions

However, it is worth to note that there is no standard definition exists for infrastructure, let alone tailored specifically to be used for disaster. As stated above, the term infrastructure is used in at least five major research areas to describe different usage of the term. From these 170 documents, 10 original definitions of infrastructure were found, that fulfil the criteria of having both information and certain infrastructure which may include technology elements. These 10 definitions range from different disciplines as shown in Table III.

TABLE II. CONSULTED DATABASES

Document type	ACM	IEEE	Science Direct	SAGE	Emerald	Total
Conference paper	14	10	0	0	0	24
Journal article	6	1	85	46	8	146
TOTAL	20	11	85	46	8	170

TABLE III. COLLECTED DEFINITION OF INFRASTRUCTURES

Authors	Definition
A. R. Mori [5]	Protocols that are essential for effective interoperability and the integration of different applications and services; for example, standard formats for healthcare messages and documents, data dictionaries/metadata repositories, structured care profiles/clinical pathways.
B.J. Hicks et al. [1]	The range of functional elements of the IS infrastructure and their integration.
Chan et al. [2]	Understood as an ICT infrastructure of an e-government initiative to be a platform, portal, or gateway where the spectrum of e-services offered by the government can be accessed.
N. Hanna [6]	The main “hard” component of e-development but its development and dynamism depend on “soft” policies and regulations to induce both supply of and demand for telecommunications. This infrastructure enables the sharing of knowledge and information among various actors in the society. It is the main

	prerequisite for the introduction of high value-added applications, especially in e-business and e-government as access precedes service rollout.
J. Pohl [9]	The creation of a communication environment that will provide seamless horizontal and vertical connectivity among all echelons in support of an effectively coordinated disaster response capability.
R. Blanning et al. [10]	Is to aid in economic development and in social and human resource development. There are three basic components in the framework, which includes (1) identifying the players and their plans and actions (2) immediate consequences of the plan (3) impact of the programs in terms of potentials for economic growth and social advancement.
R. Scott [7]	Described as those human resources, organizational and administrative structures, policies, regulations, and incentives that facilitate fully integrated and sustainable use of innovative ICTs and services to improve health care in an organized response to health and health care needs, issues, and challenges (ie, eHealth).
S.S. Raza Abidi & Z. Yusoff [11]	The proposed knowledge management philosophy, circumventing the nature of Group Data Services and their generation and delivery environment. The flexible Infostructure can support data warehousing techniques, data exchange and collation tools, data services specifications front-ends, data analysis and interpretation routines and data visualization paradigms.
T. Noseworthy [12]	A system of computers and communications networks that electronically interconnect medical professionals, facilities, equipment, and consumers to facilitate the exchange of health information for health maintenance and medical treatment. Ideally, the health infostructure has three loops of interconnectivity: provider, patient, and claims processing.
Uddin, N., Peters, R., and Haque, A. [8]	All data, control signals and interaction will flow in this layer. Examples of information using this structure are sensor outputs, accumulated data from surveying, and voice interactions from telephone.

B. Integrating Infostructure Definition

Based on the various definitions of infostructure found from the literature, it can be summarized that infostructure is defined as information created that includes both soft and technical elements in providing communications to involved stakeholders.

Additionally, based on the undertaken analysis on all existing definition of infostructure, a definition that covers infostructure specifically for disaster management can be created. It achieves the previously mentioned objectives of the study, to create a specific usage of the term infostructure in the area of disaster management. The definition is as follows:

Infostructure is information created that follow certain hierarchical coordination approach that include soft

structures elements, promoting information sharing by delivering content and resources to stakeholders via a coordinated approach, equipped with ICT infrastructure including systems and communication technology.

V. CONCLUSION

The term 'infostructure' is a term considered in its infancy, which undergo rapid evolution and used in various disciplines. Following the analysis of a group of academic articles, it has been shown that no distinct definitions exist for infostructure, clearly illustrating there is no standard definition for it.

This article provides a narrow and initial study in building the definition of infostructure as it is tailored to the discipline of disaster management. Through the analysis of all the authors' definition, basic elements of infostructure were found. The proposed definition has tried to encompass all of the definitions mentioned in Table III. However, it should be noted that the definitions in Table III came from various research disciplines and is not focused specifically on disaster. Although, all the definitions came from different disciplines, effort has been made that the selected definitions contain similar characteristics, which it must have element of system, information and technology.

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