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# Establishing the IT Disaster Recovery Planning Construct

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# Americas Conference on Information Systems AMCIS2009 San Francisco

## Establishing the IT Disaster Recovery Planning Construct

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### ABSTRACT (REQUIRED)

The concept of IT disaster recovery planning is receiving an increasing amount of attention from IT practitioners and business managers due to its importance in averting disasters and ensuring the continuity of organizations. Surprisingly, little research has been aimed at providing a comprehensive definition of this topic. Thus, this manuscript describes the process by which conceptual definition of IT disaster recovery planning is developed and an exhaustive listing of the construct's dimensions is derived via content analysis. In this meta-study, 72 articles were found to yield 572 individual planning recommendations related to IT disaster recovery planning. The data were analyzed using a clustering technique and formed into 7 dimensions and 16 sub-dimensions. The results can be used to guide organizations' IT disaster recovery planning processes.

### Keywords (Required)

IT disaster recovery planning, domain definition, content analysis, measurement

### INTRODUCTION

Organizations have become more reliant on information technology (IT) which is becoming integrated into all parts of those organizations. This puts greater emphasis on the IT professional to keep the services provided by the technology working. In the U.S., regulations such as Sarbanes-Oxley and HIPAA require some organizations have a disaster recovery plan. In light of these government regulations and the importance of IT to organizations, 28% of IT executives either do not know what their plan to continue is or know they do not have one (AT&T Global Reports, 2008). For those organizations that have full scale data centers, 22% respond that their plan needs work (Symantec, 2008). These two surveys leave out the organizations that do not have a "IT Executive" or a "Data Center."

While Information Technology Disaster Recovery Planning (ITDRP) is included in IS/IT textbooks (Fitzgerald and Dennis, 2005), is cited as important in IS/IT literature (Guster, Krzenski & Lee, 2008; Kumar, Park & Subramaniam, 2008; Ramsaran, 2005), and described in practitioner journals (See Appendix B), neither a conceptual definition nor a process for the practitioner to follow has been offered by IS/IT literature. Thus, the purpose of this paper is to introduce a conceptual definition of IT Disaster Recovery Planning and the actions that make up the planning process.

The definition is derived using content analysis. An a priori coding scheme, based on the work of Fitzgerald and Dennis (2005), was developed. Some 72 practitioner and academic articles, found in the Pro-Quest and Business Source Complete databases, were coded. Using the data cluster technique described by Krippendorff (1980), a conceptual definition was formed. As a result, ITDRP is defined as the set of actions which an organization follows in order to improve its ability to resume IT services following a disaster. The actions that an organization would follow, discussed in more depth later, are IT disaster identification and notification, preparing organizational members, IT services analysis, recovery process, backup procedures, offsite storage, and maintenance.

## DEFINING THE IT DISASTER RECOVERY PLANNING DOMAIN

Historically, IT disaster recovery planning had a rather simplistic meaning; it was generally limited to backing up data and devising methods to restore data resources. With the integration of IT into all business functions and the reliance on technology among organizational members, the complexity of IT disaster recovery planning significantly escalates. There is little guidance in IS/IT literature for the practitioner to develop and maintain an IT disaster recovery plan. Existing guidance is often incomplete on its own and inconsistent with other parts of the literature.

One area that has been confused in the literature is the difference between “IT disaster recovery” and “business continuity”. Business continuity planning address how an organization is to continue as an entity into the future, and is therefore a superset of IT Disaster Recovery. Business continuity planning is from the viewpoint of the organization and does not offer direct guidance to the IT professional. The ITDRP must be written to not conflict with the business continuity plan and must not allow the IT to sub-optimize as it is restored after the IT disaster.

Another area of confusion is what constitutes an IT disaster. IT disasters impact the organization in which the IT service is employed. IT disasters range from the accidental deletion of a file to a hurricane that destroys the building that houses the data center along with the infrastructure (such as electrical power grid) in the area of the data center. Examples of IT services include internet connectivity, telecommunications, and data storage and processing. IT services add value by providing additional capabilities to organizational members. The provision of such services relies on a combination of inputs from multiple resources, including hardware, software, data, human resources, and utilities. The loss of inputs leads to disaster only if it causes a failure in the associated IT services.

IT disaster recovery plans are for restoring IT services, not necessarily for restoring specific hardware and software architectures. It may not be possible, feasible, or practical to return to pre-disaster conditions. Disaster recovery for a service is complete when the service has been brought back online and is considered sustainable.

ITDRP does not involve simplification of IT services. The purpose of ITDRP is not to simplify IT services so that they are easier to restore, but to devise alternate ways of restoring IT services. When an organization evacuates the fit and function of the IT infrastructure while preparing an IT disaster plan, it is not prescribed that the underlying infrastructure should be simplified so as to make recovery easier. The IT services should be evaluated prior to the ITDRP process as to whether they should continue or not. Additionally, avoiding a disaster is not planning a way of planning to recovery from a disaster but disaster mitigation.

ITDRP requires an in-depth understanding of the IT services offered in terms of: 1) how the technology works 2) how the technology is configured and 3) how that system is used within the organization. Without the knowledge of all three domains, a service may not be brought back to provide the functionality that was once there. Unfortunately, the extant literature lacks a comprehensive definition which could help organizations address these issues.

This meta-study looks at the available literature and gives seven dimensions of IT disaster recovery planning and sixteen sub-dimensions that will help define for research and practice the areas that an IT disaster recovery plan should address. This will help guide future research but also guide practice to build highly reliable systems by providing a framework for the IT disaster recovery plan.

## METHOD

The purpose of this analysis is to develop a conceptual definition of IT disaster recovery planning, including a comprehensive list of the dimensions which represent the elements of the construct. The technique used to derive this artifact is content analysis. Content analysis is a research method used in the social sciences to draw inferences from text (Weber, 1985). In this case, the text includes articles which concern IT disaster recovery planning. Each reference to an aspect of IT disaster recovery was categorized according to an a priori coding scheme. The investigators independently coded each reference unit, and later convened to compare results. The initial level of agreement was approximately 85% of cases. In cases of disagreement, the researchers collectively reviewed the attributes of reference units until a consensus was reached. Over 98% of coding disputes were resolved in this manner. An independent IT professional was asked to judge the remaining cases. The results of the coding operation were iteratively refined into clusters which formed the basis of the construct dimensions and conceptual definition. This qualitative methodology is often used by information systems researchers to define concepts and frameworks in cases in which little research currently exists (e.g. Byrd and Turner, 2000; Lewis *et al.*, 2005; Templeton *et al.*, 2002).

## Sample

The population consists of all periodical articles which discuss IT disaster recovery planning. The sample was drawn from this population as follows: the Pro-Quest Direct and Business Source Complete databases were queried using keywords such as “IT,” “disaster recovery,” and “plan.” Keywords were combined using Boolean search terms in order to achieve more specific results sets. Some 121 articles were initially found. After an initial inspection, 39 were culled because the content in the articles was not in any way related to this study. For example, several articles used in the keywords “disaster recovery,” but were focused solely on humanitarian issues following natural disasters; other culled articles discussed the civil engineering aspects which follow major disasters. An additional 10 articles did not contain any useable recommendations. Thus, 72 articles were ultimately included in the sample (see Appendix B). It should be noted that the majority of the articles were published in trade publications, industry-specific magazines, and IT practitioner-oriented journals; few manuscripts came from academic or peer-reviewed sources. Many were written for audiences in the health care and financial fields.

## Recording Units

Specific references to IT disaster recovery planning were identified in the articles. Each individual reference is referred to as a recording unit. For this research, each recording unit is defined as an idea regarding what should be included in the process of IT disaster recovery planning. Each specific IT disaster recovery planning recommendation was treated as a different recording unit to code. Thus, a sentence which reads “organizations should create backup copies of data and store backups offsite” would be coded in two separate units, with each idea belonging to only one category (Krippendorff, 1980).

## Coding Scheme

An a priori coding scheme was used to categorize the data (Stemler, 2001). The coding scheme was initially based on a list of 9 elements of an IT disaster recovery plan (Fitzgerald and Dennis, 2005) (see Appendix A). This list is unique in that it does not advocate specific treatments, but provides general recommendations to consider when crafting an IT disaster recovery plan. This list was used to categorize the recording units derived from the first ten articles. After independently coding the first ten articles, the authors compared amendments and extensions to the coding scheme. Problematic portions of the coding scheme were addressed; categories were modified to the extent that they became mutually exclusive and exhaustive. As a result, the list eventually grew to a scheme of 30 elements (see Appendix A). This method has been advocated by qualitative researchers such as Weber (1990). Although the process of decoding is inherently subjective, it is expected that this can be minimized by taking additional steps such as coding independently and comparing results. The amended scheme was applied to the remainder of the units. Periodic quality control checks confirmed the enumeration.

## Clustering

A total of 572 recording units were identified and coded. The resulting data were organized into a series of 7 IT disaster recovery planning dimensions and 16 sub-dimensions. As with coding, clustering is a qualitative research technique. Thus, the most rigorous method of clustering was used (Krippendorff, 1980). The technique by which the clusters were created follows a series of 3 steps: First, the units which were most similar were identified. By similar, it is meant that their merger would have the smallest effect on the observed differences in the data as a whole. Second, the units were grouped together, taking account of the losses incurred within the newly-formed cluster. Third, the data were modified to reflect the latest configuration of clusters on which the next merger is computed. This procedure was repeated until nothing more could be merged without changing the meaning of the data.

## RESULTS

The results of the content analysis and subsequent clustering led to the development of a conceptual definition of IT disaster recovery planning: the set of actions (*IT disaster identification and notification, preparing organizational members, IT services analysis, recovery process, backup procedures, offsite storage, and maintenance*) which an organization follows in order to improve its ability to resume IT services following a disaster (see Table 1). Although the articles in the content analysis prescribed specific recommendations or unique IT disaster recovery plans, the construct is defined in relatively global terms. Because the definition is independent of specific technologies, IT architectures, and organizational governance schemes, it can be applied to a wide range of organizations.

Dimension	Description	Sub-Dimension	Description
<b>IT Disaster Identification and Notification</b>	Procedures which have been developed for detecting IT disasters, for communicating during emergencies, and for warning IT disaster recovery team members and other stakeholders.	Detection	Procedures for detecting IT disasters.
		Warning	Procedures for informing IT disaster recovery team members and stakeholders that an IT disaster has occurred.
		Means of Warning / Communication	Establishment or formalization of communication channels to be used in the event of an emergency.
<b>Preparing Organizational Members</b>	Procedures for IT disaster recovery team training, briefing for key non-team members, and the formalization of a decision-making structure.	ITDR Team Preparations	Team assignments and responsibilities during the disaster.
		Non-ITDR Team Preparations	Training and briefing of non-team members in the event of a disaster.
		Decision Making	Formalization of a decision making structure.
<b>IT Services Analysis</b>	Procedures for cataloging IT services, prioritizing IT services in terms of reactivation, and identifying potential threats.	IT Services Identification	Identification of IT services.
		Prioritizing IT Services	Listing of the order in which services need to be reactivated.
		Risks to IT Services	Identification of risks to IT services and infrastructure.
<b>Recovery Process</b>	Procedures for creating backup copies of data, software, configuration files, and the IT disaster recovery plan.	Recovery Procedures	Alternative facilities and procedures for switching operations to those facilities.
		Alternative Facilities	Recovery procedures for service inputs such as human resources, facilities, communications technologies, servers, application systems, and data.
<b>Backup Procedures</b>	The degree to which a routine has been developed for creating backups.	Backup copies of data, software, configuration files, and IT disaster recovery plans.	
<b>Offsite Storage</b>	Procedures for ensuring that systems, software and data are made as portable as possible, and those offsite locations have been selected for use as backup storage sites.	Portability	Procedures for ensuring that systems, software, and data are as portable as possible.
		Offsite Backup Locations	Offsite locations to backup data, software, configuration files, the IT disaster recovery plans.
<b>Maintenance</b>	Procedures for testing and updating the IT disaster recovery plan and its associated documentation, and for ensuring that the IT disaster recovery plan fits within the scope of the business continuity plan.	Testing and Updating	Procedures to ensure adequate testing and updating of the disaster recovery plan.
		Documentation	Documentation of configuration and changes to systems, hardware, and software.
		Synchronizing	Procedures to ensure the IT disaster recovery plan is part of the business continuity plan.

**Table 1. Dimensions of the IT Disaster Recovery Planning Construct**

## CONCLUSION

This research represents one of the first efforts at providing a systematically-developed definition of IT disaster recovery planning. A limitation of the current study is that it relied heavily on trade literature. This limitation is an extension of the cited need for this study; little research has been aimed at providing a comprehensive definition of the topic of IT disaster recovery planning. Future research should focus on the refinement of this definition. For instance, incorporating feedback from representative practitioner groups and conducting empirical evaluations will provide subsequent improvements to the current conceptualization. Additional research should aim at developing a measure for this construct, so that it may be incorporated in further research. Despite the need for additional attention, the current 7 dimension, 16 sub-dimension construct is a considerable advancement for an under-studied field. The results can not only guide future research but practitioners as they try to guard their organizations against disaster.

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## APPENDIX A: CODING SCHEMES

Initial coding scheme, adopted from Fitzgerald and Dennis (2005):

The name of the decision-making manager who is in charge of the disaster recovery operation; a second manager should be indicated in case the first manager is unavailable.

Staff Assignments and responsibilities during the disaster

A pre-established list of priorities that states what is to be fixed first

Location of alternative facilities operated by the company or a professional disaster recovery firm and procedures for switching operations to those facilities using backups of data and software

Recovery procedures for the data communication facilities (backbone network, metropolitan area network, wide area network, and local area network), servers, and application systems; this includes information on the location of circuits and devices, whom to contact for information, and the support that can be expected from vendors, along with the name and telephone number of the person at each vendor to contact

Action to be taken in case of partial damage or threats such as bomb threats, fire, water or electrical damage, sabotage, civil disorders, and vendor failures

Manual processes to be used until the network is functional

Procedures to ensure adequate updating and testing of the disaster recovery plan

Storage of the data, software, and the disaster recovery plan itself in a safe area where they cannot be destroyed by a catastrophe. This area must be accessible, however, to those who need to use the plan

Final coding scheme:

Procedures for detecting IT disasters

Procedures for informing IT disaster recovery team members that an IT disaster has occurred

Procedures for informing stakeholders that an IT disaster has occurred

Establishment or formalization of communication channels to be used in the event of an emergency

Formalization of a decision making structure

Staff assignments and responsibilities during the disaster

Training and briefing of personnel in the event of a disaster

Identification of IT services

Identification of risks to IT services and infrastructure

Listing of the order in which services need to be reactivated

Alternative facilities and procedures for switching operations to those facilities

Recovery procedures for service inputs such as human resources

Recovery procedures for service inputs such as facilities

Recovery procedures for service inputs such as communications technologies

Recovery procedures for service inputs such as servers

Recovery procedures for service inputs such as application systems

Recovery procedures for service inputs such as data

Backup copies of data

Backup copies of software

Backup copies of configuration files

Backup copies of the IT disaster recovery plan

Offsite locations to backup data

Offsite locations to backup software

Offsite locations to backup configuration files

Offsite locations to backup the IT disaster recovery plan

Measures for ensuring that systems, software, and data are as portable as possible

Documentation of configuration and changes to systems, hardware, software

Procedures to ensure adequate testing of the disaster recovery plan

Procedures to ensure continual updating disaster recovery plans

Procedures to ensure the IT disaster recovery plan is part of the business continuity plan

**APPENDIX B: ARTICLES INCLUDED IN CONTENT ANALYSIS**

The following articles were included in the content analysis:

Anderson, 2008	Jepson, 2008
Anthes, 2008	Kepczyk, 2008
April and Gryco, 2008	Kumar, et al., 2008
Ashton, 2008	Laliberte, 2007
Baker, 2008	Landa, 2008
Baltazar, 2005	Lanter, 2008
Beaman and Albin, 2008	Lindstedt, 2007
Bowen, 1999	Lohrman, 2007
Brodkin, 2008	Lundequist, 2001
Buckley, 2002	McAdams, 2008
Budko, 2007	McLaughlin, 2008
Chisholm, 2008	Mearian 2004
Connor, 2005a	Mearian, 2005a
Connor, 2005b	Mearian, 2005b
Cox, 2007	Mearian, 2005c
Crowe, 2007	Mearian and Weiss, 2005
Curtis, 2008	Pabrai, 2004
D'agostino, 2006	Patel, 2003
Davis, 2001	Plotnick, 1999
Defelice, 2008	Postal, 2007
Denyer, 2008	Pregmon, 2007a
Dignan, 2004	Pregmon, 2007b
Drill, 2005	Pregmon, 2007c
Fonseca, 2004	Pregmon, 2008
Gagnon, 2008	Preimesberger, 2008
Gale, and Scott, 2008	Ramsaran, 2005
Giannacopoulos, 2004	Retelle, 2008
Gold, 2007	Rolich, 2008
Gold, 2008	Saccomanno and Mangialardi, 2008
Green, 2005	Sheth, et al., 2008
Griffin, 2008	Sliwa, 2005
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