ACCEPTANCE MODEL OF CLOUD-BASED DISASTER RECOVERY SERVICES WITH ARTIFICIAL INTELLIGENCE

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ABSTRACT

This study highlights the critical role of IT systems in businesses and the challenges associated with managing IT risk. Companies invest substantial resources to ensure uninterrupted operations and avoid service disruptions. IT Disaster Recovery Plans (ITDRP) are essential for outlining a company's response to disruptive events, and their effectiveness is influenced by the plan's acceptance and perception within the company. Seamless availability of modern IT systems is crucial to prevent financial losses and missed revenue opportunities. Creating a disaster recovery plan is essential but can be challenging due to factors like lack of understanding, resources, and knowledge about potential obstacles. Investigating the acceptance of a recovery plan is crucial, particularly for successful recoveries. The study's main objectives include evaluating Cloud-based disaster recovery services, integrating Artificial Intelligence (AI) into Business Continuity Management (BCM) processes, and assessing the model with the introduction of mediating and moderating factors. The research design follows the UTAUT model and employs quantitative methods, utilizing cross-sectional surveys to gather data from a specific target population at a given time. Purposive sampling is used to select participants with specific traits or knowledge for valuable insights, and data analysis from 100 respondents is conducted using SmartPLS 3.0. The various determinants, such as Performance Expectancy (PE), Social Influence (SI), Facilitating Conditions (FC), Behavioural Intention (BI), and Trust (TR), that impact the acceptance of an ITDRP were studied. Integration of Cloud-based recovery services and AI into BCM processes enhances ITDRP effectiveness. Trust, mediated through intermediaries, also plays a crucial role in shaping stakeholder perception and acceptance of the plan. Ultimately, an effective plan that is user-friendly, endorsed by key individuals, supported by proper infrastructure, and trusted by stakeholders generates enthusiasm for its use. The research introduced a new variable, Trust, offering a fresh perspective on stakeholder responses to disaster recovery plans. Practical guidance is provided for companies, emphasizing the importance of trust in ensuring plan acceptance and implementation. This study has significant implications for both theory and practice in disaster recovery planning for IT systems.

Keywords: ITDRP, AI, BCM, UTAUT, SmartPLS 3.0, cloud-based disaster recovery

APPROVAL

This is to certify that this thesis conforms to acceptable of scholarly presentation and is fully adequate, in quality and scope, for the fulfilment of the requirements for the degree of Doctor of Philosophy

The student has been supervised by: **Dr. Amril Nazir**

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(26 June 2023)

DECLARATION

I hereby declare that the thesis submitted in fulfilment of the PhD degree is my own work and that all contributions from any other persons or sources are properly and duly cited. I further declare that the material has not been submitted either in whole or in part, for a degree at this or any other university. In making this declaration, I understand and acknowledge any breaches in this declaration constitute academic misconduct, which may result in my expulsion from the programme and/or exclusion from the award of the degree.

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Signature of Candidate: **Date**: 26 June 2023

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LIST OF ABBREVIATION

AI	Artificial Intelligence
AIS	Artificial Intelligence System
AMOS	Analysis of Moment Structure
AR	Augmented Reality
AVE	Average Variance Extracted
AW	Awareness
BI	Behavioural Intention
BDA	Big Data Analytics
BCM	Business Continuity Management
BCP	Business Continuity Planning
BNM	Bank Negara Malaysia
BRS	Business Resilience System
BS	British Standard
CB-SEM	Covariance-Based Structural Equation Modelling
CC	Cloud Computing
CSPs	Cloud Service Providers
CPU	Central Processing Unit
CI	Confidence Intervals
CT	Clarification Tree
C-TAM-TPB	Combined-Theory of Acceptance Model-Theory of Planned Behaviour
CR	Composite Reliability
DL	Deep Learning
DRP	Disaster Recovery Planning
DRaaS	Disaster Recovery as a Service
DTPB	Decomposed Theory of Planned Behaviour
DV	Dependent Variable
EE	Effort Expectancy
ERMS	Electronic Records Management System
ERP	Enterprise Resource Planning
FC	Facilitating Conditions

FCPA	Foreign Corrupt Practices Act
FAR	False Alarm Rate
GoF	Goodness of Fit
HA	High Availability
HTMT	Heterotrait-Monotrait Method
IaaS	Infrastructure as a Service
IoT	Internet of Things
ICT	Information and Communication Technology
IDT	Innovation Diffusion Theory
INTAN	National Institute of Public Administration
IS	Information System
ISF	Information System Function
ISO	International Organization for Standardization
IT	Information Technology
ITDRP	Information Technology Disaster Recovery Plan
IV	Independent Variable
IR4.0	Industrial Revolution 4.0
LAN	Local Area Network
LISREL	Linear Structural Relations
MAMPU	Malaysian Administration Modernization & Management Planning
ML	Machine Learning
MPCU	Model of PC Utilization
NIST	National Institute of Standards and Technology
PA	Predictive Analytics
PaaS	Platform as a Service
PE	Performance Expectancy
PDRPMR	Preventive Disaster Recovery Plan with Minimum Replica
RT	Regression Table
RAM	Random Access Memory
RTO	Recovery Time Objective
RPO	Recovery Point Objective

SaaS	Software as a Service
SI	Social Influence
SMART	Self-Monitoring, Analysis and Reporting Technology
SMEs	Small-Medium Enterprises
SmartPLS	Smart Partial Least Square
SOX	Sarbane-Oxley Act
SPSS	Statistical Package for Social Study
SVM	Support Vector Machine
SCT	Social Cognitive Theory
SRMR	Standardization Root Mean Square Residual
TR	Trust
TAM	Technology Acceptance Model
TAM2	Technology Acceptance Model 2
TPB	Theory of Planned Behaviour
TRA	Theory of Reasoned Action
UB	Use Behaviour
UTAUT	Unified Theory of Acceptance and Use of Technology
VIF	Variation Inflation Factor

CHAPTER 1

INTRODUCTION

1.0 Overview

When the primary computer system is unavailable to end users for the processing of crucial data during business operations due to a disaster, the Information Technology Disaster Recovery Plan (ITDRP) assumes a crucial role in the quick recovery of IT systems. Basically, the plan is a written guide of what to do if a company's IT infrastructure is affected by a disaster. It should include an overview, plan purpose, policy, mission, goals, plan details, team organization, methodology, disaster declaration process, and recovery strategy. Plus, it should list the teams, roles, and responsibilities of the recovery team, along with the system recovery process (Prasetyo et al., 2019). The goal of business continuity is to guarantee a certain level of service stays available while the organization returns to regular operations. An IT disaster recovery plan is essential for a business continuity plan to work properly (Cloudian, 2023).

A company that depends on computers to work properly will be in serious trouble if their systems go down. It is hard to predict when, how often, and how much disruption will affect businesses. To protect themselves from disasters, companies should come up with a plan of action and a decision-making structure (Sahebjamnia et al., 2018; Rezaei Soufi et al., 2018; Charoenthammachoke et al., 2020). Therefore, it is imperative to know the critical determinants or aspects of the plan that will influence its acceptance and use of the plan, and identifying them upfront will give policymakers a heads-up and take necessary actions before embarking on a recovery program (Wunnava, 2011; B. Davison, 2014; Afshar, 2014).

Furthermore, various AI techniques, such as decision support tools, can be used to aid in various disaster management phases (Sun et al., 2020). Other cases include using cloud computing as a formidable option for companies trying to improve their disaster recovery capabilities. Companies can make sure that their crucial data and systems are backed up and quickly available in the case of a disaster by utilizing the scalability, flexibility, and cost-effectiveness of cloud-based solutions. AI has the potential to revolutionize disaster management by increasing the efficiency and efficacy of backup and restoration operations, monitoring the health of IT equipment, and other functions. In times of crisis, AI can process massive amounts of data from numerous sources faster than humans, enabling for faster and more accurate decision-making. AI can automate data classification and retrieval for backup and restore procedures, making it easier to locate and restore crucial files. Many of today's backup products have incorporated AI for various different tasks including Acronis, Cohesity, Commvault, Dell EMC, Rubrik, UniTrends, Veeam, and others (Otey, 2023).

In order to increase a plan's acceptance and adoption, it can be extremely helpful to understand its essential aspects and features. Companies can help to overcome resistance to embrace and support the use of new recovery methods and tools by giving stakeholders a clear knowledge of how the plan works, what it can do, and how it can benefit them.

1.1 Background of the Study

The protection of data and IT systems from potential calamities requires the use of a recovery plan. The benefits of implementing the solution are immense. It can significantly minimize the losses due to revenue reduction and other costs by drastically reducing restore time and it also helps in minimizing the interruption of critical processes and safeguarding business operations (Maida, 2018). Not having a

DRP in place can put companies at high risk of high financial cost, reputational loss and even greater risks to their clients and customers (Zhang et al., 2022). Generally speaking, as businesses adopted and used technology, they ran into organisational, technological, and individual issues. It is now required to find the key elements driving the adoption of information systems (Mukred et al., 2020; AlBar & Hoque, 2017). Because of its relevance in the recovery of IT systems, companies that intend to implement the recovery plan may ask which determinants are crucial to influencing stakeholders to adopt the plan. The plan's success depends not only on how important it is, but also on how well it is accepted. Even though the advantages of the plan may be obvious, stakeholders and businesses will need to be on board in order for it to work. This can depend on how efficient and simple it is to use.

Nonetheless, disaster recovery in information systems is a hot area of security for safeguarding data against undesired situations, and it entails a set of methods for system continuity to support the continuity of computerised business processes. Business continuity includes disaster recovery, and disaster recovery planning is a component of business continuity planning (Hamadah, 2019).

Several studies (Mikalef et al., 2018; Mugeni et al., 2020; Habibi Rad et al., 2021; Zaman et al., 2021; Behl, et al., 2021) process catastrophe-related data using artificial intelligence (AI) approaches to support strategic disaster management. An overview of current artificial intelligence (AI) applications in disaster management was described in an article by (Sun et al., 2020) over four phases: mitigation, preparation, response, and recovery. This makes an interesting topic as AI can help in disaster management.

Cloud storage and AI have revolutionized the way companies manage data backups and prepare for disasters. Cloud storage offers scalability, flexibility, and cost-effectiveness, so businesses can be confident that their data is protected if anything ever goes wrong. AI can be used to study data utilization and prioritize which data to back up, and it can also automate the backup process, meaning less manual labour and less risk of human mistakes (Ramesh et al., 2023).

Technological elements like artificial intelligence (AI) implementations, encompassing tasks like monitoring, analysis of geographical data, methods for remote sensing, utilization of robots and drones, machine learning, telecom and networking provisions, examination of accidents and critical areas, and evaluating environmental effects, play a pivotal role in driving societal transformation. These elements bear noteworthy consequences for investigating how societies react to potential dangers and unforeseen calamities (Kamran Abid et al., 2021; Tomaszewski, 2021; Izumi et al., 2019).

Likewise, Kuglitsch et al. (2022), articulated that Artificial Intelligence (AI), specifically machine learning (ML), is poised to assume a progressively pivotal function in diminishing disaster risks. This encompasses forecasting unprecedented events and formulating hazard maps, instantaneously identifying occurrences, offering situational understanding and decision-making aid, and extending even further by employing AI to furnish crucial insights to policymakers and stakeholders, all aimed at mitigating the perils posed by disasters.

Similarly, Xu et al. (2021) claim that AI holds significant promise in a variety of domains. For example, in the utility industry, AI-driven risk control and management can prevent costly equipment malfunctions by utilizing sensors. These sensors monitor and transmit data about the condition of the equipment to the manufacturer, allowing the manufacturer to anticipate possible problems and implement preventive measures such as timely maintenance or automated shutdown procedures.

The statements explain how artificial intelligence (AI) can be used in disaster recovery planning. It describes a number of AI applications that can be used to monitor flooding in and around buildings where computer centres are located, as well as the use of machine learning algorithms to monitor the health of IT equipment, including telecom and network services, which may impact connectivity by remote branches to the main IT systems located at the main office.

In addition to several useful AI-based decision support tools, it gave instances of various AI techniques and their advantages for disaster management at several phases. It also revealed that most AI applications are concentrated on the disaster response stage. For actual AI applications in disaster management, there are a number of difficult problems with data and processing, as well as the inseparability and repeatability of analytical results (Schofield, 2022).

1.2 Problem Statement

A written document outlining how to quickly get back on track after information technology outages is called an ITDRP. Certain stakeholders may not be too keen on it because it requires changing their daily routines and workflows, which can result in low acceptance for the plan. To make the plan more appealing, the key aspects of the plan must be identified and assessed.

The problem at hand is to determine the specific aspects and features, and benefits of the plan that will resonate with stakeholders and encourage them to embrace the challenges. This may involve conducting surveys, focus groups, and other forms of research to gather feedback and insights from them.

Furthermore, having a plan may not guarantee a successful recovery as some steps or artefacts may be left out or having insufficient artefacts to support the recovery process. Similarly, new divergent and different dangers emerge every day, and the best advice is to test the plan regularly, taking into consideration new technologies that may make the regular recovery plan not able to meet the requirement.

There could be several reasons why stakeholders do not accept the plan. Some of the reasons include:

i Failure to comprehend the features of disaster recovery plan and may view it as an unnecessary task or to take a low priority;

ii Lack of resources: disaster recovery planning can require significant resources, including time, money, and personnel. Some companies may not have the resources available to devote to developing and implementing a comprehensive disaster recovery plan;

iii Complexity: Disaster recovery planning can be a complex process, involving the identification of risks, the development of backup and recovery procedures, and the coordination of multiple teams and stakeholders. Some stakeholders may be intimidated by this complexity and may therefore be hesitant to engage in disaster recovery planning;

iv Challenge: While much is known about the internal factors that influence the relationships between the constructs of a disaster recovery plan, there is a gap in the understanding of other factors that may intervene in and/or interact with these relationships.

The gaps in the knowledge of a disaster recovery plan can hinder the ability to effectively recover from disasters. By addressing these gaps, the needs for a better disaster recovery plan can be had.

By determining the key features of recovery plans, this study aims to help companies better understand the critical aspects that affect the successful acceptance of a recovery plan. In short, this study seeks to enhance the understanding of IT disaster recovery planning by exploring information relevant to the development of such a plan.

Also, it is crucial for companies to have a disaster recovery plan in place, but implementing it can be challenging without the appropriate knowledge and technology tools. Simply relying on data backups and IT equipment is not enough; personnel support is also necessary for the recovery process (Shah et al., 2019; Sakurai & Murayama, 2019).

Moreover, the task of recovery has become increasingly complex due to the interdependencies among IT systems, cloud computing, globalization, and virtualization (Tariku & Lessa, 2021; Cavallo & Ireland, 2014). Developing a disaster recovery plan is challenging in today's fast-paced technological landscape (CO-OP Solutions, 2017; Finucane et al., 2020), and there is no universal solution as companies have different IT systems and services. A single, generic plan may not be sufficient for recovery due to the various types of outages that can occur during a disaster. This research gap highlights the need to enhance recovery efforts.

Lastly, there is a lack of understanding about the other external factors that may influence the relationships between the components of a disaster recovery plan (Ashrafi & AlKindi, 2022).

In conclusion, this study has identified several gaps in the understanding of disaster recovery planning. These gaps include a lack of knowledge about the external factors that may influence the relationships between the features of a disaster recovery plan, as well as the need for more comprehensive research on the most effective strategies for addressing these gaps. By addressing these gaps in knowledge, improving the ability to effectively recover from disasters and better meet the needs for effective recoveries is attainable. For example, as the IT landscape changes, a dynamic plan that incorporates AI can be implemented to address concerns. Coordinating comprehensive disaster recovery planning with the Business Continuity Management lifecycle will result in improved recovery planning.

1.3 Objectives

The primary objective of this study is to determine the factors that affect user acceptance of the ITDRP with PA. Understanding the determinants – combined with the various moderating variables – will aid in understanding which salient dimensions of the plan will influence companies' behavioural intention and use of the plan. From the findings, an improved process can successfully support disaster recovery of IT activities in organisations.

The following are the specific goals of the study:

i To identify the key aspects of ITDRP;

ii To evaluate Cloud-based disaster recovery services;

iii Introduction and adaption of AI into BCM processes;

iv To assess the study model by introducing factors that improve, worsen, negate, or otherwise alter the correlation between the independent and dependent variables.