



Information Technology Disaster Recovery Plan Framework for Banks in Ethiopia

Completed Research Paper

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ABSTRACT

IT services and solutions in the banking sector should be protected to keep the business continuity in a disastrous scenario. This study aims to develop an Information Technology Disaster Recovery Plan (IT DRP) framework in the case of Ethiopian Banks. Qualitative case study method is employed to investigate current best practices and challenges in Ethiopian banks. The findings indicated that Banks do not have IT DRP in place. Lack of framework, lack of focused group, lack of experiences, and lack of standardization are some of the challenges identified. Accordingly, the IT DRP framework is proposed for Banks of Ethiopia. The framework is confirmed and validated by the subject experts. The framework can serve banks as a quality tool to evaluate existing IT DRP or develop new ones based on their business needs. Recommendations are also forwarded and related topics are suggested for future research to extend this work.

Keywords

Business continuity, IT disaster, IT disaster recovery plan, disaster recovery.

INTRODUCTION

Disaster recovery (DR) is a recovery of critical technology assets in the catastrophic IT failure events. Information technology disaster recovery (ITDRP) is about the recovery of technology-based resources such as applications, data, network connectivity & IT peripheral/hardware. DRP can be distinguished as more a tactical document that provides a short-term plan to deal with IT-specific disruptions to an organization such as cyber-attack or system failures. DRP concentrates not only on the mitigation of the disaster but also to respond to and recovery of IT systems. Disaster recovery (DR) is considered as part of a business continuity (BC) management program (Protiviti, 2015). Business Continuity (BC) in IT is the uninterrupted availability of IT resources that support key business functions. It is a general term that includes disaster recovery. The interest in BC and DR has increased in the last few years, especially with the increasing corporate dependence on computer systems and the growing levels of devastation associated with recent disasters.

An IT disaster recovery plan is an IT-focused plan designed to restore the operation of the intended systems, applications, and computed facility infrastructure at an alternate site after a disaster. A mission-critical or essential business process functions of BCP or COOP (Continuity of Operations Plan) can be supported by DRP by recovering such supporting systems at an alternate location. IT DRP also deals with an information system (IS) disruptions that require relocation (NIST, 2010).

The causes of disaster recovery are multifold. The incidents such as fire, flood, tornado, hurricanes, etc. have the potential to cause damage to buildings, equipment, and IT systems. The effects can be direct damage to buildings, IT equipment, and IT systems, causing buildings uninhabitable and systems unusable. There is also a utility outage that can cause no direct damage. But the essential supplies such as power, water, and others are interrupted to wider areas for days or so. In most cases, businesses simply can't survive after experiencing such an outage that causes them to cease operations for hours, days, or longer and this is a big loss for businesses like banks (Gregory, 2013).

The major benefits of DRP are improved business processes, improved technology, fewer disruptions, higher quality services, and competitive advantage. A DR plan allows an organization for better availability and reliability of services. Businesses can leverage these benefits if and only if disaster recovery plan is in place among other things. In today's environment, most organizations depend on systems and online transaction processing. Hence, system interruption for a few seconds can lead to million-dollar losses to an organization.

The modern sense of banking service in Ethiopia began towards the end of Emperor Minilik II. And the first bank was opened in 1906 E.C in cooperation with the British owned National Bank of Egypt and it was called the Bank of Abyssinia. Currently, there are 16 private and 2 government-owned banks and one central bank in Ethiopia that transact millions of birr per day. Nowadays, there are natural and manmade disasters that could prevent the banks from performing their tasks. Banks are coming up with highly sophisticated technologies to get competitive advantages over their rivalries, but this is not enough for banks to stay in the market for a long time as natural or manmade disasters could disrupt their business process and the whole system for an extended time. So banks need to adopt BCPs and disaster recovery strategies to avoid intentional or unintentional problems that prevent the system from operating its normal business processes (Haylay, 2017).

The purpose of this study is to identify the gap in the Ethiopian banks' disaster recovery planning practice and propose an ITDRP framework that can guide them in their IT Disaster planning endeavor.

The paper is organized as follows. The following section presents the research gap. In section three, a literature review is presented followed by the method in section four. Then, results and discussion of the research results are presented. Finally, the proposed framework is presented and conclusions are made.

RESEARCH GAP

Business continuity is vital for any organization to survive in a competitive environment. It is too critical for organizations dealing with financial services and online data processing, where a fraction of a minute may worth several millions of dollars. In today's environment, most organizations depend on systems and online transaction processing. Hence, a disaster for a few seconds can lead to million-dollar losses to an organization. An incident that drew the attention of the international community towards disaster recovery was the 9/11 attacks of the World Trade Centre twin towers in New York in the year 2001. This incident forced governments of every country to emphasize on the significance of disaster recovery strategies to their key organizations. The International Federation of Red Cross and Red Crescent Societies (IFRC) identified 7184 disasters from 2000 to 2009, ranging from the Bhopal disaster, the tsunami in Indonesia in 2004, hurricane Katrina in 2005, the Haiti earthquake in 2010 and the Chernobyl explosions to the September 11th attack on the World Trade Centre in New York. They caused an estimated 986,691 million dollars of economic damages, millions of casualties while billions of people were affected. (World Disaster report, 2010).

Kadlec and Shropshire (2010) found out that 60% of United States companies don't have IT disaster recovery plans in place. The IT disaster recovery planning guides developed were also inconsistent or complicated and the resources were not complete. It was also reported that on the IT DR planning practices of 154 banks in the United States, those organizations with adequate IT disaster recovery plans do not have IT budget and the size of their IT department was small.

IT disaster recovery plan has been one of the main concerns for IT management (Kappelman, McLean, Johnson, & Gerhart, 2014). An effective IT disaster recovery plan is essential for organizations to protect them from data loss (Hawkins, Yen, & Chou, 2000). According a study by Kappelman et al (2014), IT disaster recovery occupied the tenth place in top concerns for IT executives. Where the main purpose is to respond to any disastrous events at the earliest time possible, ITDRP can help the organization to ensure that their essential services and business processes continue operating in the event of a disaster (Hawkins, Yen, & Chou, 2000). In

a study by Uddin and et.al. (2015) in banking and the financial sector, it was found that 59.7% of the functions were mission-critical in the financial industry and 32.3% of the mission-critical activities need a recovery time objective (RTO) of less than 4 hours. Furthermore, 96.9% of the functions should be recovered within less than 72 hours. It was also found that approximately 90% of the organizations were getting executive-level support for BCP and DR. But only 23% of the top-level executives thought of BCP and DR as top-level critical activities (Balouris, 2009). Another study indicated 6% of organizations are using ISO standards for business continuity, namely ISO 27001 and ISO 27002 to a larger extent and 45% of organizations have not considered ISO standards at all due to lack of decision-makers and influencers (Balaouras, 2009). These figures prove the fact that a DR plan cannot be implemented exactly by using a template or guideline, rather they will be helpful when creating a customized disaster recovery plan to cater to the business requirements. This implies that international standards should be customized to fit into Ethiopian bank's context and culture.

Ethiopian Banks introduced various new products and services on the local market to gain a competitive advantage over the internal as well as global players. These products mainly included new credit facilities, saving schemes, project financing tools, investment banking tools, mobile banking, and new e-banking facilities. Consequently, the operational risks in the banks are exposed due to large dependency on automated systems and centralized databases have become critical. Ethiopia is amongst the developing countries that are most vulnerable to natural and man-made disasters (NBE, 2019). A study by Mohammed (2009) showed that 54.8 % of the companies faced a disaster in their computer systems, and infrastructure threats found to be the largest cause, and the software was the most affected part. Same study revealed that 76.3% of the companies had the plan, but did not follow all the necessary procedures and components of the plan. Nigussie (2017) on his study assessed IT disaster recovery practices in the commercial bank of Ethiopia and found that there was an ITDRP framework gap. According to Haylay (2017), the study found that 42.1% of the banks implemented ITDRP; whereas 57.9% of the banks didn't put into work so far. Whereas 42.1% of banks that have the plan in place are still supposed their plan is not real as it needs major technical improvements to meet its intended purpose. Hence, the researchers concluded that ITDRP was not exercised well at Ethiopian banks. Therefore, ITDRP is receiving significant attention from researchers and practitioners. The previous local studies revealed that there is no IT DRP Framework developed for Banks in Ethiopia. Thus, motivated by the problem on the ground and as suggested by scholars in recent related works, the researcher is aimed at developing an IT DRP framework for Banks of Ethiopia.

REVIEW OF RELATED WORKS

There are few pieces of literature on DRP investigation and assessment.. Haylay (2017) investigated the current ITDRP status in Ethiopian Banks using mixed methodology. The study found that 58% of the banks have no ITDRP in place. According to this study, there was a lack of ITDR framework and standardization, the problem of ITDRP adoption, lack of top management involvement, the problem of risk identification, and management perception. Furthermore, there was no ITDRP update, maintenance, and test performed for those that developed the ITDRP. The study did not include other financial sectors.

An assessment of ITDRP on commercial banks of Ethiopia has made using the qualitative method. 51% of the respondent agreed there was no risk control mechanism and 25% confirmed risks and its impacts on the bank had not been analyzed. 40% responded there was no IT DRP in place and the banks had not considered any international standards at all. Besides, IT DRP human aspect, updating, maintaining, and testing were the components that had been overlooked by those branches that implemented it. The study found and recommended the ITDRP framework as a future study. This study did not consider the private banking sector (Nigussie, 2017).

Both Mohammed (2014) and Mueen et, al. (2015) used a qualitative approach to develop a model for organization and ITDR framework for the bank of Sri Lanka respectively. Although the bank framework was more related, the technology gap, culture and context of the organization, the human aspect, and the knowledge gap, and the type of risk and nature of disaster are far different from our country's perspective. In conclusion, there is no literature on DRP Framework conducted either on banks of Ethiopia or other sectors in the Ethiopian context.

The following list of themes were identified from the pieces of literature and interview questions were devised and prepared accordingly.

- **Project Initiation:** Businesses must establish the need for disaster planning and define a project plan to guide development efforts. The major tasks included in the initiation stage are: securing management support, organizing the planning project team, establishing the project management process, obtaining the required resources, and developing initial project objectives (Luckey, 2009).
- **IT Business and Service Analysis:** A series of assessments to identify the core IT business scenarios, IT business impacts, potential IT threats and risks, inventory of all IT systems and associated services, and resources deployed to support them. It consists of **IT Inventory**, **IT Risk assessment** and **IT impact analysis** (Kadlec and Shropshire, 2009; Somasekaram, 2017).
- **Develop IT Recovery Strategies:** Define and specify the approaches, policies, procedures, and processes to implement the needed resilience to achieve the principles of incident prevention, detection, response, recovery, and restoration. It includes Human aspect and responsibilities, IT DR action plan strategies and IT DRP testing, and evaluating strategies (Somasekaram, 2017; Acronis, 2016; Susan, 2007; Hossam, 2014; Kadlec and Shropshire, 2009; Hossam, 2014; NIST 800-34).
- **Develop an ITDRP Plan:** Based on the information and steps listed above, identify and prepare an ITDRP documentation of specific policies and procedures to be used in the event of a disaster (Hossam, 2014; Acronis, 2016; Susan, 2007; BS ISO 22301:2012; NIST 800-34).
- **Conduct Test, Exercise, awareness, and training:** Give bi-annual awareness and training once the plan has been developed. Overall testing should also be conducted per annum or quarterly as needed by the bank. Exercising after the new training and awareness is mandatory and recommended by pieces of literature (Hossam, 2014; Acronis, 2016; Susan, 2007; BS ISO 22301:2012; NIST 800-34)
- **Conduct Disaster Recovery Plan maintenance and Audit:** Changes are inevitable, IT DRP requires continuous support and maintenance to fit the current requirements. Auditing the IT DRP documents, the technology, and human aspects are crucial to fit changes and preparedness (Hossam, 2014; Acronis, 2016; Susan, 2007; BS ISO 22301:2012; NIST 800-34).

METHOD

The research approach used for this study was qualitative and the strategy selected was a case study. Case study research involves an intensive study of a single unit to understand a larger class of (similar) units observed at a single point in time or over some delimited period of time (Sasa, 2014). As such, case studies provide an opportunity for the researcher to gain a deep holistic view of the research problem and may facilitate describing, understanding, and explaining a research problem or situation. Purposive sampling was employed to select the participants from both government and private banks. A face to face and telephone interview was conducted to collect the data from the banks. Thematic analysis is used to interpret the interview data. The validity and reliability of the framework were done by domain experts. The participants for this study were IT Audit directors, IT Security Directors, risk managers, IT Data Center managers, CIOs, IT security Managers, BC and ITDRP managers, IT infrastructure and services managers, and incident teams and managers who are located at Addis Ababa city head offices of the two banks.

RESULTS

The interview involved asking questions, listening to, take notes, and recording answers from an individual and group in a structured and semi-structured format in an in-depth manner. The interview question was written in English and the answers were in Amharic to ease communication between the interviewer and interviewee. A translation of language and transcription of the recording was made to present the data.

After data was collected and organized, the transcribed interview data was sent to both banks for expert validation. The experts from both banks confirmed that this will greatly help them in the process of IT DRP framework development underway. They commented each area should be included and have no point to drop. The expert validation was chosen to brainstorm and gain different views of the business continuity and IT DRP, security directors, security managers, risk managers, and other experts who work in both Bank A and Bank B of Ethiopia in various IT positions. The knowledge of the subject matter of the expertise in IT DRP will help to gain valuable inputs and proper investigation of the proposed IT DRP framework. Besides, the experience of the knowledge area experts in the Banks in different positions also adds value to the holistic view of the proposed Information Technology disaster recovery plan framework.

The themes and key findings are presented below.

Project Initiation: The results from both banks' interviews showed that both Banks have initiated the project, top management support is secured, the project team established, and no budget issues.

IT Inventory: Bank A deployed an automated Asset Management System. Bank B uses a spreadsheet to manage inventory. IT hardware and software related to DR is identified in both cases.

IT Risk Assessment: There is a lack of an IT risk assessment focused group in Bank B. Both banks assessed the impacts disaster has on IT systems.

IT Business Impact Analysis: Recovery Point Objective (RPO), Recovery Time Objective (RTO), and Service Level Agreements (SLA) are not set in both cases. Only premium agreements for critical applications are in place.

Recovery Strategies: Both banks are on the pre-planning stage. No standardized backup and recovery strategies in place. There is a lack of organized human elements and only cold site is in place (no guaranteed telecom backline) in both cases.

Disaster Recovery Plan: IT DRP document is not developed and there is a lack of specific procedures and policies

Awareness, Training, Test & Exercise: Pre-plan awareness and training for the selected developing team were conducted. But there is a lack of certified trainer and no test conducted on development areas.

Maintenance & Audit: IT Audit follow up is there and forces the bank per the regulatory bodies but there is a lack of Maintenance as there is no IT DRP implemented in both cases.

DISCUSSION

The literature revealed that without conducting an effective project initiation process, an IT DRP strategy will be incomplete and potentially unsuccessful when activated. For example, an IT professional who attempts to develop a DR plan without engaging other subject matter experts and managers will not be able to accurately assess the time-critical systems or the needs of each relevant stakeholder (Snedaker, 2013). Both Bank A and Bank B tried to prepare a disaster recovery document without project initiation and were not successful. The infrastructure service management division head of Bank B stated that they had a pseudo-IT disaster recovery document that they used to show the regulatory bodies. Later they found that it was incomplete and decided to initiate an IT DRP project from scratch. This was due to a training taken by the Bank managers on BC and DRP organized by Ethio telecom.

In the IT DRP project initiation phase, system requirements are identified and matched to their related operational processes, and initial contingency requirements may become apparent. Very high system availability requirements may indicate that redundant, real-time mirroring at an alternate site and fail-over capabilities should be built into the system design. Similarly, if the system is intended to operate in unusual conditions, such as in a mobile application or an inaccessible location, the design may need to include additional features, such as remote diagnostic or self-healing capabilities. During this phase, the IT system also should be evaluated against all other existing and planned IT systems to determine its appropriate recovery priority. This priority will be used for developing the sequence for recovering multiple IT systems (John and James, 2005). The

business continuity and disaster recovery manager of Bank-A confirmed, they are on the project initiation phase and have been identified as critical systems but have not ranked them accordingly as they need to do BIA first.

A Business Impact Analysis (BIA) aims to determine which resources warrant the expense and effort of distinct inclusion in a disaster recovery plan. A BIA further specifies the priority by which each time-critical system is recovered after a disaster. The close examination of technology and business processes necessitated by a BIA can also identify potential changes that will reduce system interruptions or improve service quality. An assessment of current literature indicates that the creation of a BIA is a best practice that should play a central role in DR planning activities. A recent survey of business continuity managers reveals that 20 percent of businesses with continuity plans do not have a current BIA on file, and one-third of those companies with a BIA have failed to keep it up to date (Gregory, 2013; Bradbury, 2008). Accordingly, the business continuity and disaster recovery manager of Bank A and Infrastructure service management division head of Bank B stated that they have not developed BIA such as recovery point objective and recovery time objective reasoning telecommunication infrastructure limitation as a challenge.

The literature and international standards proved that the first step in the prioritization process is to define a maximum tolerable downtime (MTD) for each time-critical IT system that specifies how long the business can function after the system fails. The business should also calculate a recovery time objective (RTO) that declares how quickly the system should be restored. The RTO must be less than the MTD to account for delays in the resumption of work after a system outage. The final step in the prioritization process is to create a recovery point objective (RPO) that identifies the amount of information that a business can afford to lose permanently from each system during a disaster. The RPO will determine how frequently electronic data must be backed up to an offsite location from which it can subsequently be restored after a disaster has taken place (Bradbury, 2008; Gregory, 2013; Snedaker, 2013).

Per the conversation with Bank A and Bank B's CIO and business continuity and DR manager respectively, customer and business requirements are identified, external dependencies (i.e., government, industry, and legal) are identified, a business risk assessment is underway, management support is obtained and project planning are initiated. They explained they will follow the standards like ISO (Bank A) to prioritize the process.

DR planners should also meet with key members of the company, such as those responsible for facility management, to analyze the potential risks with which the company is faced. Such risks could include concerns ranging from a fire or flood in an IT server room to a major earthquake or hurricane that destroys entire facilities. Secondary effects of disasters such as utility and communication outages should also be considered as potential risks. A formal approach that organizations can follow to identify and prioritize the risks that could lead to a disaster includes: (1) identify each potential disaster that could affect time-critical IT systems; (2) assign a value between 1 and 10,000 that represents the likelihood of each disaster, with 1 being the least likely to occur; (3) for each disaster identified, rate the potential impact on the time-critical IT systems, again using a scale of 1 to 10,000; (4) multiply the likelihood values by those estimated for the impact; and (5) sort the results to list the risks with the highest calculated numbers, representing the most significant risk, first. The broad range of values allows companies to distinguish clear priorities between many potential risks (Sneaker, 2013; Gregory, 2013).

The IT Audit director of Bank A confirmed that they follow formal risk assessment and audit based risk assessment approach in assessing the risk in the Bank. This complies with what the literature stated above.

Recovery activities can be conducted in three approaches. The first one is to move operations to the Disaster Recovery Backup Site and the Emergency Operations Center. This activity will begin with the activation of the Disaster Recovery Plan. The second one is to recover critical business functions, restoration of the critical applications, and critical network connectivity. The goal here is to recover the systems and network so that the customers can continue the business. The third one is to return data processing activities to the primary facilities or another computer facility (Bryan, 2019). In Bank A and Bank B only vendor based recovery activities and strategies are in place.

To adequately respond to a disaster, a business must have a "well-thought-out, documented" DR plan in place. IT DR planning best practices indicates that it is during the IT DRP development stage that organizations specify (a) how to react to disaster scenarios, (b) when to activate a DR plan, (c) how each critical IT system should be recovered, and (d) who should perform needed recovery tasks. The key elements identified within this section can guide DR planners as they develop and document IT recovery strategies based on the information identified

through the BIA process (Spencer & Johnston, 2003). It was well justified by both bank's IT managers that they do not have an IT DRP document in place.

Although no specific law states that a business must have a DRP, there is a body of legal precedent that has been used to hold companies and even individuals responsible for the recovery of data after a disaster (John and James, 2005). According to the business continuity and disaster recovery manager of Bank A, the regulatory bodies like the national bank of Ethiopia necessitates the development of the IT DRP plan. It was also confirmed by the CIO of Bank B that the regulatory body and the internal IT auditors urge the bank to have IT DRP in place.

According to National Institute of Standards and Technology (NIST) Publication SP800-12, the purpose of computer security awareness, training, and education is to enhance security by Improving awareness of the need to protect system resources; Developing skills and knowledge so computer users can perform their jobs more securely; and Building in-depth knowledge, as needed, to design, implement, or operate security programs for organizations and systems.

Awareness stimulates and motivates those being trained to care about security, resource and reminds them of important security practices such as IT disaster recovery. Explaining what will happen to an organization, its mission, its customers, and its employees when security fails or disaster occurs often motivates people to take security more seriously. The success of a disaster recovery effort depends on the effectiveness of the response team. For this reason, all individuals who are assigned a position in an IT DR plan should be included as regular participants in DR testing. It is also important to involve the response team in DR plan testing to give those individuals experiences that enable a "cool and competent" response to a disaster. In addition to training through involvement in recovery testing, other sources such as conference room training and seminar-based instruction should be utilized. If employees are not properly trained to implement a DR plan, the planning efforts will have effectively been "wasted" (Rothstein, 2007; Spencer & Johnston, 2003; Teuten, 2005)

Bank A and Bank B IT managers and CIO confirmed that they have no IT DRP plan to maintain. Bank A and Bank B had not conducted post-implementation training, awareness, and testing since they have no IT DRP in place. But they have conducted some IT DRP awareness for the IT DRP development team who recently initiated the project.

Due to the continuously changing nature of risks that face time-critical IT systems, businesses must ensure that DR plans are updated regularly to reflect the current environment. Depending on the frequency and complexity of changes, maintaining a DR plan "may end up being the biggest challenge" of the DR planning process for some businesses. However, developing an explicit strategy to address DR plan maintenance can reduce the complexity of the task (Teuten, 2005; Snedaker, 2007).

PROPOSED FRAMEWORK

The proposed ITDRP framework for Banks of Ethiopia tries to present all relevant ITDRP steps in one view. The steps and concepts are drawn from the literature. The Framework clearly shows the sequences of the steps, the dependencies between the different steps, and the overall process in a consolidated way. There is a clear requirement to build a conceptual framework essential for recognizing IT DRP for Banks of Ethiopia. The vital aim of the IT DRP framework for Banks is to build, review and document a reasoned and easily comprehensible plan which will aid the Banks in recovering swiftly and efficiently from the unanticipated emergencies which act as a deterrent to the functioning and operations of the Bank. It also enumerates the role, process and the list of requirements that shall be utilized to organize and regulate the circumstances after a disaster has occurred

The framework will be used to ensure consistency of disaster recovery planning practice among Ethiopian Banks. It will increase the efficiency and effectiveness of the services provided by the banks. It can also be extended to other financial sectors with minimum modification and used as a major input to develop an IT DRP framework for other organizations in Ethiopia as it is developed in the context of Ethiopian Bank's culture, technology, understanding, knowledge gap, and human elements factor. The final proposed framework is as below. There is no difference between the proposed and final framework as the area expert made no comments to drop any theme or concept from the previously proposed IT DRP framework.

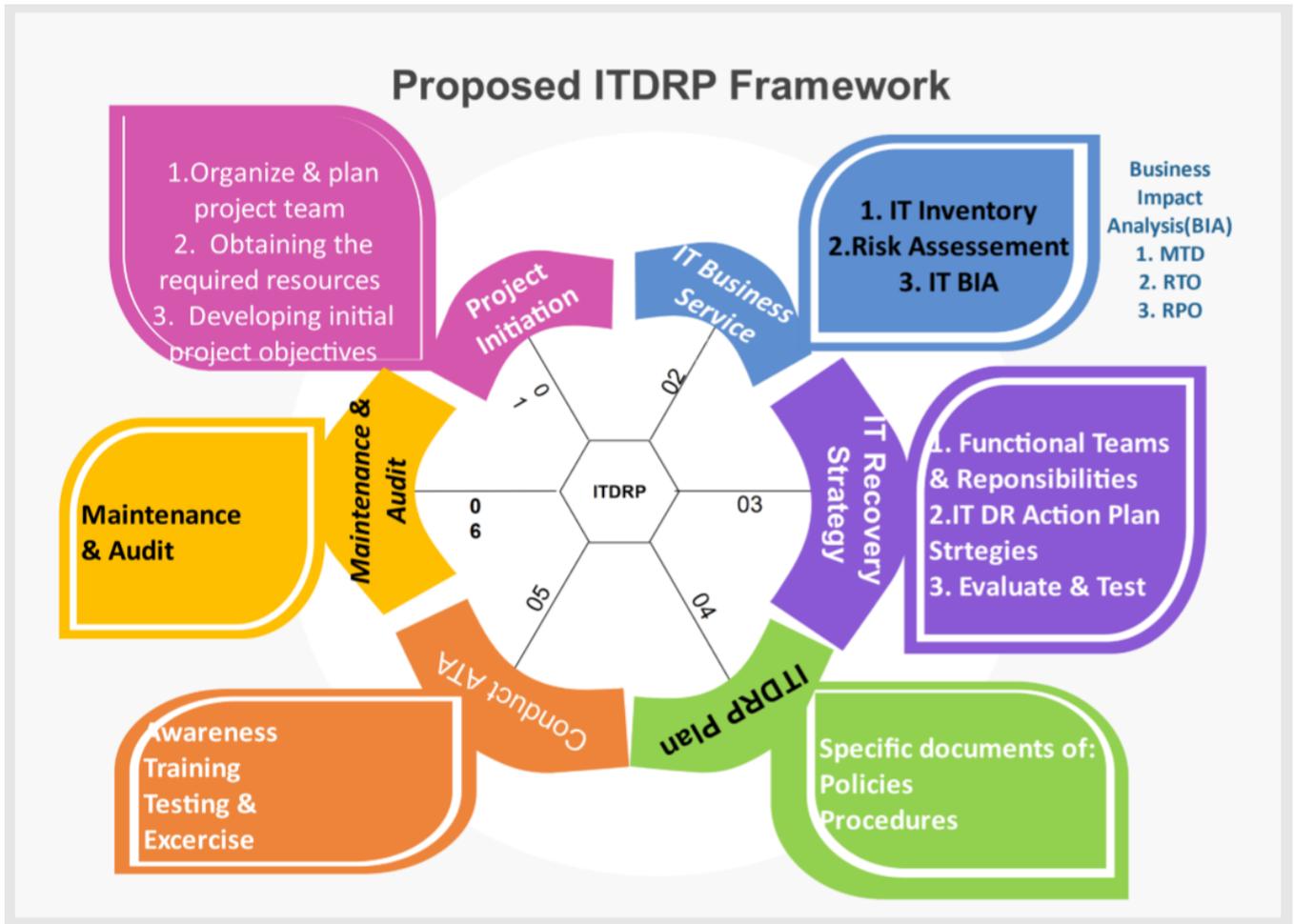


Figure 1: The proposed ITDRP framework

CONCLUSION

The objective of the study was to propose an ITDRP framework for Ethiopian Banks that can be used as a base for developing their respective disaster recovery plans by identifying current practices and challenges and assessing other frameworks done elsewhere. Accordingly, an assessment of current practice was made and challenges were identified from one government-owned and other private-owned banks in Ethiopia. Per the study, the strength of Bank A related to the study is the establishment of the IT business continuity and disaster recovery department which deals with any IT disruption scenarios. Also Bank A has well established IT security directorate and IT audit directorate with subsections to deal with IT security issues and IT audit and evaluation activities respectively. An added strength of Bank A is the implementation of automated asset management software to deal with the IT inventory system which is one component of the IT DRP plan document. The follow up of the IT audit to necessitate the development of IT DRP is the strength of both Banks and regulatory bodies like the national bank of Ethiopia. According to the participants, the limitation of a guaranteed strong backbone network between the data center and recovery site provided by the service provider in the country is a challenge to both banks.

The study is limited by the current level of understanding of the IT DRP plan document development, implementation, training, testing, and updating in the country in general and in the Banks in particular. Some of the topics except the pre-planning phase such as project initiation and risk analysis are difficult to gather sufficient data about. The planning and post-planning phases are not implemented in both cases. The study is limited to one tool that is interview as the document analysis and observation were

not available and possible so that triangulation was not achieved per the plan. Banks were not willing in some cases to admit weaknesses in security measures and do not want to share information that can be used to expose vulnerabilities concerning IT risk analysis and assessment. In most cases, the banks were willing to share information regarding the topic.

Based on the analysis and findings, the following points are concluded.

- If IT DRP is not in place, ability to recover systems and restore lost critical-data is impossible and there is a subsequent financial and economic loss to the banks and the country
- Identifying and prioritizing critical, dependency requirements, and essential business functions and IT systems are the ability to deliver sound banking services that depend on systems and gaining community and customer confidence that proudly rely on the bank's best service.
- Recovery time objective and recovery point objective determines a bank's ability to provide the basis for identifying and analyzing viable strategies for inclusion in the IT DRP plan
- Recovery strategies allow banks to quickly respond to crises and recover as many critical-functions and systems as possible.
- Pre and post-training, awareness, and exercise ensure the capability and skills of the IT DRP team to relocate and restore before and after disruptions and disastrous scenarios.
- Audit and maintenance of IT DRP document eliminates obsolescence technology and services and cope up with new systems which are directly proportional to fast relocation and restoration of critical services and data.

To cope up with the current advance in cyber-attacks, threats, and risks of IT-related disasters the following further issues are recommended for future research to benefit the banks and other financial organizations in the country: IT DRP framework for financial sectors and industries; multi-vendor outsourcing, multi-vendor cloud, and multi IT solutions DRP framework for banks and financial sectors; business continuity and disaster recovery framework for banks and financial sectors; and the role of educational institution in solving scarcity of BC and DR professionals in the financial and other sectors

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