UNIVERSITY OF MAKATI

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College of Computing and Information Sciences

Technological Research Information System

Capstone Project 1

Presented to the Faculty of the

College of Computing and Information Sciences

University of Makati

by

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CHAPTER I

THE PROBLEM AND ITS BACKGROUND

This chapter discussed the study's rationale and the research questions the researchers want to investigate. Specifically, this chapter's discussion included the introduction, background of the study, statement of the problem, objectives of the study, hypothesis, scope and limitations, significance of the study, and definition of terms.

Introduction

Modern digital technologies are advancing rapidly, driving transformative changes. The Information Systems (IS) for educators, maintaining curricula that prepare graduates for the digital economy is imperative (Hwang et al., 2024). In the contemporary global world, the growth rate of IS usage is high, and it now has become an agent of development for individuals, organizations, and governments at large. It has an impact on all facets of life. The performance of organizations and their ability to withstand the competitive power depends on the extent to which they deploy their Information System (Al-Kofahi et al., 2020).

In academia, the management of research information is continuously evolving. The introduction of Technological Research Information Systems, such as Current Research Information Systems (CRIS), provides a centralized platform that integrates various elements of research management. According to Elsevier (n.d.), these systems not only improve the efficiency of accessing academic materials such as theses and capstone projects but also enhance the overall management of research activities by linking various processes within the research ecosystem. This is particularly important for institutions that generate large volumes of research data, ensuring that valuable academic outputs are accessible, organized, and efficiently managed.

Ahmad and Alammary (2022) pointed out that limited access to previous research is a major obstacle to innovation. Many institutions don't have digital archives for academic research, making it difficult for students and faculty to access past work. This lack of access holds back knowledge sharing and fresh ideas, as it prevents students from building on prior research, thereby restricting opportunities for novel contributions. Also there is the significant challenge for students and academic institutions in securing collaborations is often due to their failure to leverage the benefits of past partnerships.

Academic institutions may not fully integrate previous industry collaborations into future strategies, resulting in missed opportunities for continued partnerships and innovation (Casado Lopez & Fussenegger, 2021).

According to Athulya & Dileesh (2020), "Technology encryption is continuously changing as it faces new emerging challenges in cloud security, which includes data confidentiality, integrity, and availability." With such latest developments, new techniques have emerged before, including Attribute-Based Encryption, which provides fine-grained access control, while the hybrid methods combine both the AES and RSA algorithms to ensure protection of data during its transmission. More importantly, recent developments in identity-based proxy re-encryption and public auditing mechanisms shine light on scalability with privacy preservation, fulfilling the demand for secured shared cloud environments. Computational efficiency while highlighting the incorporation of strong encryption schemes are deemed of importance when it comes to protecting sensitive information.

The primary objective of this study is to investigate the impact of effective research information systems on the organization's performance. As stated by Bhattacharyya et al. (2022) Inventory management is a life-blood vein in most of the organization. The objective of the information system is to address challenges such as enhancing information management and augmenting operational efficiency. By automating repetitive tasks, minimizing errors, and facilitating fast and efficient communication, information systems can assist companies in enhancing their operational efficiency (All-Staging, 2023).

Ultimately, This study aims to make a significant contribution to the field of information gathering by building upon and refining previously published ideas and concepts, integrating past industry collaborations into future strategies to create opportunities for continued partnerships and innovation. Findings of this research will have practical implications for us as researchers, by equipping us with enhanced knowledge and experience in managing and utilizing research information systems effectively.

Background of the Study

The College of Computing and Information Sciences (CCIS) of the University of Makati is offering a comprehensive ICT education program which comprises three baccalaureate degrees and two diplomas for the academic year 2024 – 2025. This is aimed at providing industries and business

organizations with useful and appropriate information technology skills. In a similar fashion, the College of Technology Management (CTM) presents four baccalaureate degrees, four diplomas and one certificate program in the year 2024 – 2025. Both colleges aim at training personnel who have the adequate knowledge and skill to fit them in the job market. In particular, CTM seeks to nurture professionals who are ready for the industry by integrating theoretical and practical modes of training in its curriculum.

Both colleges are dedicated to quality education that is relevant to the industry and that prepares the students with knowledge and skills that are sought after by the business and industrial sectors. They are technology driven as well, as they seek to create products and services that enhance creativity. Last but not least, both of these college's institutions focus on exploratory research, where new knowledge is created and adds value to society and encourages innovation. As for the college's curriculum in their final academic year, students have an obligation to undertake capstone projects or write their theses.

Both colleges, CCIS and CTM handle a significant volume of capstone projects and research outputs annually. Students from CCIS produce approximately 118 book-binned capstone projects and scholarly research, while students from CTM produce around 72 book-binned projects and prototypes each academic year. As of this time, the inventory management system of both colleges for hard-binned projects and research are handled manually. The CCIS uses Microsoft Excel to archive metadata of the capstone projects and research, such as the titles, authors, and year of publication. While the CTM relies on CDs for archiving and accessing projects and research outputs, they require the students to submit their work along with a CD containing the softcopy of the documents and the project itself. Additionally, both colleges have limited office space, which restricts student accessibility. This results in inefficient document handling, difficulties tracking capstone projects and theses, and challenges accessing specific files for data subjects in both colleges.

In this regard, implementing a Technological Research Information System will innovate and facilitate the needs of administrators, faculty, and students for managing published academic materials, accessing specific research materials, and maintaining protective measures to ensure that only authorized users can view the capstone projects and theses.

Objective of the Study

The general objective of the study is to develop the model of the Technological Research Information System Repository of Capstone Project and Thesis web application in the College of Computing and Information Sciences and College of Technology Management. The study specifically aimed to achieve the following objectives:

1. Design the Technological Research Information System (TRIS) with the following features, functionalities, and security measures:

    1.1. User Management

    - Super Administrator: Provides the ability to approve publishing, view, add, remove users, modify roles, manage permissions, and control access availability within the system.
    - Administrator: Provides the limited ability to view, add, remove users, manage permissions, and control access availability within the system.
    - Security measures: Enforce secure password policies (16 character cases sensitive with special character and number), account lockout after 3 failed login attempts, and CAPTCHA to prevent brute-force attacks.

    1.2. Research Inventory Management

    - Catalog management: Facilitate efficient retrieval, viewing, adding, editing, and removing of capstone projects, scholarly research, and related resources.
    - Security measure: Implement validation and sanitation of user inputs to prevent injection attacks when managing research data.

    1.3. User Collaboration and Knowledge Sharing

    - Enable document rating and feedback to foster academic interaction.
    - Provide cross-referencing tools to connect related studies and support collaborative learning.
    - Maintain accessible, shared academic resources that encourage community engagement.

    1.4. Automate and Standardize Citation Management

    - Develop an automated citation generation feature supporting multiple formats (e.g., APA, MLA, Chicago).
    - Simplify research documentation to enhance academic integrity and consistency.

    1.5. Industry Collaboration

- Include a directory of industry partners to facilitate future research collaborations, list of companies researchers previously collaborated with.
- Align academic projects with industry needs to foster innovation and leveraging past partnerships.

1.6. Security

- Implement multi-factor authentication (MFA) for user access (phone number or email address, and using Google Authentication).
- Employ end-to-end encryption (SHA-256 and AES 128).
- Use role-based access control (RBAC)
- Record detailed audit logs of system activities and user interactions for enhanced security and policy compliance.
- Apply session timeout to automatically end inactive sessions, preventing unauthorized access due to unattended accounts.
- Backup and Restore.

1.7. User Experience and System Usability

- Design a mobile-responsive, user-friendly interface for students, faculty, and administrators.
- Digital bookmarking, reading lists, and tailored notifications for enhanced usability and accessibility.

1.8. Reporting and Analytics

- Reports generation and export capabilities to track access, usage, and system interactions.
- Revenue Tracking
- Data analytics to provide insights into research trends, user activity, and usage patterns.
- Ensure that generated reports are accessible only to authorized users, with secure logging for all report access

2. Develop the system using the following tools:

2.1. VSCODE

2.2. CodeIgniter

2.3. PHP Development

2.4. HTML
2.5. CSS
2.6. MySQL
2.7. JavaScript
2.8. Python

3. Test the system prototype based on the prescribed parameters.
4. Evaluate the proposed system based on ISO 25010 in terms of:
   4.1. Functional Suitability
   4.2. Usability
   4.3. Reliability
   4.4. Security

Significance of the Study

This research proposal aims to develop a model for the Technological Research Information System Repository of Capstone Projects and Theses for the University of Makati specifically the College of Computing and Information Sciences and the College of Technology Management. The current system struggles with inefficiencies in accessibility, tracking, and limited storage, making it increasingly difficult to manage the growing volume of academic resources. This project seeks to address these challenges by automating retrieval, optimizing resource utilization, and leveraging digital solutions for scalability and remote access. The goal is to improve accessibility, reduce retrieval time, and enhance overall efficiency, benefiting both students and faculty members.

University of Makati. The faculty and students of the University of Makati have developed several projects and other research papers pertaining to scholarly productions that, in essence, are limited access to those associated with the college, and ideally, these colleges can find the said digital repository of the study adapted to their respective colleges.

College of Computing and Information Sciences. This study would assist faculty members and students to preserve and access scholarly research materials and projects.

College of Technology Management. This study would assist faculty members and students to preserve and access scholarly research materials and projects.

Students. A central system for storing projects and research materials will help students easily find relevant studies, improving their academic work.

Researchers. This study helps researchers modernize old systems to align with advancing technology, promoting innovation and future research opportunities.

Future Researchers. This study will provide and assist future researchers in promoting innovation and advancing future research..

Scope and Limitations

The study involves the development of the model of the Technological Research Information System Repository of Capstone Project and Thesis for the University of Makati, specifically the College of Computing and Information Sciences and College of Technology Management. The study will be conducted during the academic year 2024-2025, with the purpose of enhancing the department's current repository capabilities, improving students accessibility, and enhancing protection through cloud security measures.

There are specific limitations associated within the system, the primary challenge is the heavy reliance on the utilization of the Internet, to enable access and monitoring. Technological constraints, adaptability on the side of the users, as well as other factors consisting of institution policies and resource availability, also influence the system's implementation, efficiency, and sustainability.

Operational Definition of Terms

TRIS - Technological Research Information System a web application that will help students, administrators, faculty and staff also researchers to find and access research information they need.

CCIS - College of Computing and Information Sciences a college within a University of Makati that focuses on programs related to computing and information sciences.

CTM -College of Technology and Management a college within a University of Makati that focuses on programs related to technology and management.

Data analytics - involves examining, organizing, and interpreting raw data to uncover patterns, trends, and insights. It uses statistical, computational, and visualization techniques to help organizations make informed decisions, solve problems, and predict future outcomes.

Streamline - refers to the process of simplifying or optimizing tasks, systems, or workflows to improve efficiency and reduce unnecessary complexity.

Granular controls - Ability to specify detailed and precise access rights for different users or groups. Allows system administrators to restrict access in a way that only specific users or groups can access certain tables of data in databases.

Sanitation - In the context of web and software development refers to the process of validating and cleaning user inputs to ensure they are safe for the system to process. This involves removing or escaping potentially harmful characters.

Leveraging - refers to the strategic use of resources, tools, or assets to achieve a specific goal or maximize results.

Revenue tracking - is the process of monitoring, recording, and analyzing an organization's income from sales, services, or other streams over a specified period. This helps businesses understand financial performance, identify trends, and make data-driven decisions to optimize profitability and growth.

Cross-referencing - typically refers to linking or comparing data across different tables, fields, or records within the database to ensure consistency, validate relationships, or gather comprehensive insights.

Cross-Site Scripting (XSS) - Type of security vulnerability commonly found in web applications. It allows attackers to inject malicious scripts (usually JavaScript) into web pages that are viewed by other users.

AES 128 (Advanced Encryption Standard with a 128-bit key length) is a symmetric encryption algorithm used to secure data by converting plaintext into ciphertext. It is known for its balance of strong security and performance, making it suitable for various applications such as secure communications, data storage, and financial transactions. The 128-bit key size ensures a high level of encryption strength.

SHA256 - (Secure Hash Algorithm 256-bit) is a cryptographic hash function that generates a fixed 256-bit (32-byte) hash value from input data. It is widely used for securing data, verifying integrity, and in blockchain technology due to its resistance to tampering.

CodeIgniter - Toolkit for people who build web applications using PHP. Develop projects much faster, providing a rich set of libraries for commonly needed tasks, as well as a simple interface and logical structure to access these libraries.

CHAPTER II

CONCEPTUAL FRAMEWORK

This chapter puts forward an extensive discussion of relevant resources considering journals and previous studies that offer the basis for the carrying out of the research. In addition, the conceptual framework of the study is located at the end of this chapter.

Types of Research Information Systems

Current Research Information Systems (CRIS) in Academia

According to “Understanding the role of digital technologies in education: A Review” (2022) The globalization of education has already necessitated the application of digital technologies. Online platforms were available for conducting classes, sharing resources, doing the assessment and managing the day to day activities of academic institutions. The instructor becomes a guide in this process and can approve learning efficiency. Using the myriad of digital resources, learners may download the required information or upload their content. This simply indicates that by utilizing digital technologies to support students in producing pertinent resources and sharing them, technology enhances the inspiration and significance of learning.

As stated by Jan Recker (2021) The study of the development, use, and impacts of digital information and communication technology involves a diverse array of questions and approaches, which makes information systems research both exciting and challenging; Research in this are is multifaceted and comprehensive, yielding insights from a variety of perspectives and lenses that increase our knowledge about the role of information systems in our lives and help make positive changes in our world.

Supported by citation in the "Determining the impact of technological modernization and management capabilities on user satisfaction and trust in library services" (2022) ICT have made digital libraries more user-friendly and turned them into mobile library applications that make it easier to access resources. The use of technology has proven to be a driving force behind the integration of various resources and other service components into the organization and development of the learning environment. The development of technology besides databases has also appeared in the form of mobile internet technologies. In this situation, the development of smart devices has allowed the creation of libraries that provide mobile services, including mobile sites, text messaging services, e-books, catalogs and easy access to resources.

Digital Repositories for Higher Education Institutions

According to Ahmad and Alammary (2022) Developing a national level digital repository linking all universities can enable students and faculty to search and download capstone project reports and university essays. This provides an extensive environment for university students to promote novelty and solve indigenous problems. Additionally, mining repositories can reveal important patterns of students' abilities, areas of interest, team structure, work distribution, and time taken in relation to successful project completion. This citation further elaborates the importance of creating a digital repository for the College of Computing and Information Sciences by providing centralized storage and sharing, assuring originality, revealing insights for curriculum improvement, and promoting student work. This provides extensive benefits to students, faculty, and universities.

Open data can enhance the credibility of research by facilitating re-analysis and replication of reported study results, which helps the education community know what findings are credible and should be considered for translation into policy and practices. That is, other researchers can confirm the accuracy of reported findings by independently conducting the same analyses with the same data. According to Funk C, (2020) a recent Pew Research Center survey reported that among a sample of 3,627 U.S. adults, 57% said that they trust scientific research findings more when data are openly available.

Essential Features for Research Information Systems

Advanced Search and Filtering Functionalities

Garrido et al. (2022) claimed that Web-based file management was a system that made file sorting and management easier. Primary, it will benefit faculty members and administrators to a well-organized repository that will be aid to students who look for resources. The security is also in advantage, as all of the data is kept in a single storage location, where only respective admin, faculty, and students under the college are only permitted to access. Having the "search" feature can allow the users to easily find the specific topics, year it was published, and the authors of the capstone and research materials. To maintain the credibility of the system it must contain regular maintenance system checks to ensure the operation is well-constructed.

Collaboration Features

Casado Lopez and Fussenegger (2021) highlight the significance of fostering strong university-industry collaborations through the integration of various tools that bridge the gap between academia and industry. These tools, such as project management systems, communication platforms,

and directories of industry partners, facilitate smoother interaction and greater alignment of goals. Similarly, the Technology Research Information System (TRIS) incorporates features designed to streamline communication, enhance collaboration, and support innovation by connecting researchers with industry stakeholders, ensuring a more efficient and productive partnership.

Digital Repository

Texas Digital Library (2019) With institutional repositories, repository managers often listed advocacy as a main challenge. More specifically, they found it an ongoing challenge to build relationships with faculty members and others to submit works to the repository or to understand the functions of the repository as it relates to digital preservation of scholarly works. Adopting digitization for preservation among institutions presents significant challenges, as balancing advanced technology with traditional library practices is crucial. Each year, the graduation of students generates a substantial number of capstone projects and research papers. While preserving physical books in libraries remains essential, sharing information and using it for related literature can be restricted by other institutions to prevent plagiarism. Additionally, a challenge faced by libraries is the lack of access to specific topics due to the absence of online information or search features within their systems.

User Satisfaction and Accessibility

Bhat (2019) determined the availability of e-theses collections across agricultural libraries in northern India, calculating the proportion of users for each e-theses collection, and assessing user satisfaction with the availability and adequacy of e-theses. The researchers studied and surveyed seven universities as sampled to collect data, and a survey questionnaire was used for data gathering. By these results, it gives wide understanding on how digitizing collection of theses can help users satisfaction and the availability of the information in their own devices, with the caution of using it as an instrument for only references and knowledge.

Security

Importance of Audit Trails

Carcary (2020) highlights that an audit trail enhances the trustworthiness of qualitative research by providing a systematic, transparent record of the research process. This trail enables other researchers to scrutinize methodological and analytical decisions, ensuring that findings are grounded in evidence and not merely subjective interpretation. By documenting both the physical and intellectual stages of the research process, the audit trail mitigates criticisms often directed at qualitative research, such as a lack of rigor or researcher bias, making the study more credible and reliable.

Role-based Access Control (RBAC)

According to Blundo, Cimato, and Siniscalchi (2020), Role-Based Access Control (RBAC) is a method of managing access permissions by assigning them to roles, which users can then inherit. This model enhances scalability and manageability in large organizations. The authors explain that constraints, including cardinality and separation of duty, are critical to ensuring security within an RBAC system, though these constraints can also increase the complexity of role mining efforts, especially when optimizing role definitions.

Password Security with 16-Character Requirement

According to Ur et al. (2019) the study *"How Does Your Password Measure Up? The Effect of Strength Meters on Password Creation"* by researchers at Carnegie Mellon University investigates how password-strength meters influence users' password choices, particularly in terms of security and complexity. Conducted with over 2,900 participants, the study tested 15 variations of password meters with differing visual displays and scoring algorithms to assess their impact on password length, complexity, and cracking resistance. Findings revealed that while all meters encouraged slightly stronger passwords, stringent meters led to significantly longer and more complex passwords that were more resistant to cracking but often frustrated users. The study suggests that a balance in meter stringency is essential for promoting stronger passwords without overwhelming users, providing insights for the design of more effective security tools.

Additionally according to the Whitman and Mattord (2021) Information Security Fifth Edition case-sensitive password using a standard alphabet set of 16 characters with no numbers of special characters the odds of cracking is 43,608,742,899,428,900,000,000 while the estimated time to crack is 2,362.1 years. While the case-sensitive password uses a standard alphabet set of 16 characters with numbers and 20 special characters, the odds of cracking is estimated at more than 4 Nonillion while the estimated time to crack is 226,332,789,392.1 years.

Importance of Encryption in Educational Data Management

According to the statement of AxCrypt (2024), data and file encryption is considered to be the first barrier to any data infiltration and any attacks on the network. This is also per the advice of experts such as IBM and Microsoft. It is very helpful in providing protection especially in the educational sector from unauthorized access of turnitin websites. Last but not least, educational establishments have become more and more computerized, wide-ranging and open with the number of universities, colleges and schools on the uptrend rapidly over storage of sensitive information. From personal details about

students and their grades to even more sensitive research works which raises the volume of data they have to manage.

Cypher.dog (2024) places great attention on encryption, especially in the education sector where email encryption is presented as the primary aspect. Most of the information in learning institutions is passed through emails, and most times, if not all, these messages are encrypted, so the content can only be accessed by the right recipients. In accordance with the Family Educational Rights and Privacy Act of 1974, learner information cannot be disclosed by the educational institution, thus making it applicable to encrypt the data in order to present compliance and prevent loss of sensitive information.

Encryption can save educational institutions money and resources by preventing data breaches and reducing the risk of reputational damage, it also improves the institution's reputation and trustworthiness by showing how committed institutions are to protect sensitive information (CYPHER.DOG, 2024). Moreover, using encryption provides numerous benefits for the sector of education, it ensures compliance with the confidentiality, integrity, and availability while having the privacy of those within the institution, it also helps to lessen or prevent cyber-attack and data breaches that provide peace to users.

Trends in Encryption Technology

Data security is critical for organizations like educational institutions. Managing sensitive information requires equipping Management Information System Software with security measures like user authentication, data encryption protocols like SSL & TLS, and firewall security; all this is necessary to defend against unauthorized access controls into the system. Most vendors provide granular control over the types of permissions and a complete audit trail that shows every activity performed on each document. These are all essential to prevent any data breach or data manipulation that will have severe consequences like ransomware, reputational damage, and significant financial losses (Nyggs-Team, 2024)

The study by Athulya, V. S., and E. D. Dileesh. "Study on Encryption Techniques Used to Secure Cloud Storage System." (2020) examines various encryption techniques specifically applied to cloud storage environments that protect sensitive data. The author provides a comprehensive overview of encryption methods that ensure data confidentiality and security in cloud storage systems, which are often vulnerable to security threats like unauthorized access, data breaches, and cyberattacks.

Collaboration and Knowledge Sharing

Industry Collaboration Directories

The study of "Barriers and facilitators of university-industry collaboration for research, development and innovation: a systematic review" stated that the cooperation in research, development and innovation (RD&I) between universities or research institutes and industries plays a fundamental role in the economic development of a country. Industry benefits from state-of-the-art laboratories and technologies from academia, while institutes learn about business reality and market needs. Alongside the traditional functions of universities to provide higher education and professional training, they must also strive to fulfill their entrepreneurial mission of creating innovation.

Importance of Inventory Management Systems

As stated by Bhattacharyya et al. (2022) Inventory management is a life-blood vein in most of the organization. If the inventory management practices are followed by the organizations in an effective and diligent way, the organization’s profitability will be increased.

In agreement with Ezeocha and Ogohi (2020) Physical records can be easily lost due to various factors such as natural disasters, accidents, or theft. When critical inventory data is lost, businesses may face operational disruptions and challenges in maintaining accurate stock levels. This can lead to stockouts or excess inventory, both of which negatively impact financial performance.

According to “Design and Implementation of an Inventory Management System in libraries using Radio Frequency Identification Technology” (2019) Inventory process in libraries nowadays is still performed using manual traditional inventory management techniques, by scanning or reading books individually. This results in inconsistency in the inventory process, increase in inventory management time and misshelving of the collections. In their research Alwadi et al. (2017) stated that manual inventory techniques demand a high level of resources with regard to the number of people and time required to perform the task, which are likely to introduce human errors, hence affecting the efficiency of a library management system.

Comparison of On-premise and Cloud Hosting

According to “Cloud ERP vs. On-Premise ERP” (2020) Cloud-based software means that you don't have the system at premises, but access the network using technological information resources that have been provided by a vendor based on predefined agreement. The device should have internet access to access all these resources, and no client installation is needed. While on the other hand, On-premise software is installed locally on a company's computers and servers. The implemented software features may be accessed usually through client components installed on the client's machine.

Another implementation is called "Hybrid" deployments, a cloud solution that features an element of different types of IT deployment models, ranging from on-premises to private and public clouds.

Cloud Optimization for Efficient Data Access

Megahed et al. (2019) entitled —Optimizing cloud solution designǁ, the authors presented the importance of the cloud as well as building a cloud solution and encouraging companies to move from local environments to the public, private, or mixed cloud solutions where the requirements are provided to the user by the cloud service provider at low costs in a short time. In this case, problems are modeled by analyzing data, summarizing the problem, and programming it correctly to solve problems. By designing cloud solutions that meet customer requirements, cloud supply constraints, and solution access at lower costs and short time. The authors in this paper evaluated both approaches and demonstrated the effectiveness and efficiency of cloud solutions of all kinds (public, private, or hybrid) on local environments.

Data Quality and Management Challenges

Elizabeth Adegbaju and Isaac Odun-Ayo (2022) Having warehouses in multiple locations makes it difficult to maintain high-quality data on inventories. Organizations are forced to maintain individual records per site to ensure that data quality is sufficient for their planned use in operations, decision-making and planning. This will cost organizations more money in terms of staffing, mistake rectification and system maintenance.

Data Integrity and Lifecycle Management

Sustainable Data Practices

Chauhan et al. (2023) Deliberated on the sustainable development potential inherent in intelligent supply chains. They underscored the imperative of intelligent supply chain management, placing particular emphasis on the future elements of sustainability. The discussion highlighted the need to consider environmental, social, and economic factors in intelligent supply chain management to achieve sustainable development.

Maintaining Data Integrity Across Lifecycle Stages

Ivanov et al. (2024) Through the analysis of practical cases, have deduced some common features of the cloud supply chain, constructing a comprehensive model for this paradigm. Simultaneously, they have identified future research directions for the cloud supply chain. Inventory management within the context of the cloud supply chain stands out as a crucial area of contemporary

supply chain research. The integration of cloud technology, data analytics, and digital platforms heralds a new era in supply chain operations, presenting both opportunities and challenges for effective inventory management. This chapter will conduct a retrospective review of previous literature from three dimensions, elucidating the research gaps and contributions of this study compared to prior research.

To this end, there is a need for new and scalable metadata models that are designed to structure, uniquely identify and link data using open but secure protocols. Hence, there is now a growing consensus that metadata that are enriched, linked, open and effectively filtered enhances the discovery, access, and usage of resources(Alemu and Stevens, 2015; Gartner, 2016) To justify a return on investment, the metadata work must not only be adaptable to changing user needs and ever-growing diversity of resources but also provide interoperable and scalable approaches in its creation, exchange, use and management so as to proactively meet user requirements. The overall aim of these layers of applications and services is to enhance the sharing, exchange and re-use of data so as to also streamline decisions and generate new knowledge.

Cloud and on-premise hosting have different cost-effectiveness, using cloud hosting is priced in monthly or annual subscription with additional recurring fees for support, training and updates, companies for cloud-based need to pay for the resources depending on the consumption, but they will not pay for maintenance and upkeep costs. The on-premise is generally priced under a one-time perpetual license fee that is usually based on the organization's size or the number of concurrent users and it has a high initial cost and is more dangerous. Companies that decide to deploy on-premise ERp systems are responsible for the servers hardware's ongoing costs, need operating system licenses, firewalls, antivirus, power consumption, and space (Hughes, 2018).

Efficiency and Real-Time Data Management

Surucu et al. (2024) Systematically elucidated the pivotal role of digital transformation in enhancing supply chain information sharing and processing. They revealed the dynamic capabilities, driving factors, and impediments associated with digital information sharing based on blockchain and cloud platforms. The study emphasized the methods and theories applied in its supply chain applications. This research provides robust theoretical support for investigating inventory management issues in cloud supply chains, underscoring the significance of digital information sharing and highlighting the reliability of data-driven approaches within cloud supply chain contexts.

Pillars of Cybersecurity for Research Repositories

People, Process, Technology (PPT) Framework

In the article Stakeholders' Opinions Support the People-Process-Technology Framework for Implementing Digital Transformation in Higher Education (2023), the authors consider the People, Process, and Technology (PPT) framework's application in the context of the digital transformation of higher education institutions in third world countries, as expressed by Benavides et al. (2020). Within the literature review, there are three fundamental issues that each of those developing countries has experienced in the process of digital transformation. Specifically, the first set of issues is inevitable people-related issues that include the challenge of acting in ways that drive the desired change and enhancing the requisite skills, knowledge, and abilities to reap the gains of the change. Process-related issues mean that an organization and its educational systems need to be prepared to embrace a new coherent structure with the assistance of technology. Finally, the technology-related issues are those concerning the necessary technology such as its availability, capacity, and affordability.

This evidence clearly demonstrates that the PPT framework is a structured means of integrating an organization's existing resources for the effective support of system implementation. It allows participants to undergo such training that would introduce them to the new processes and prepare them, as well as the organization, technically in order to achieve the objectives while optimally performing the tasks.

CIA Triad: Confidentiality, Integrity, Availability

The CIA triad is foundational to cybersecurity, emphasizing data confidentiality, integrity, and availability. TRIS integrates these principles to ensure academic data remains protected and accessible only to authorized users. According to Mitchell and Osazuwa (2023), the CIA triad (confidentiality, integrity, and availability) remains a foundational concept in information security. As technology advances, the increasing complexity and interconnectedness of network systems call for an expanded security framework that includes additional dimensions, such as privacy, controllability, and authentication. Addressing these intricate challenges requires a collaborative, multidisciplinary approach that involves expertise from various fields. Ultimately, Mitchell and Osazuwa emphasize the need for further research into both theoretical and practical applications of security, enabling organizations to establish effective security policies. In a rapidly advancing technological landscape, a continuous commitment to enhancing security protocols is essential to protect against evolving threats.

Synthesis

Online platforms facilitate teaching, sharing resources, assessments, and daily administrative tasks. This indicates that utilizing digital technologies to support students in pertinent resources (Haleem et al.., 2021). The development, use, and impact of digital information encompass a wide range of questions and approaches, making information systems research both engaging and complex (Recker., 2021). Digital libraries have become more user-friendly through the transformation into mobile library applications, facilitating easier access to resources. The use of technology has proven to be a driving force in integrating various resources and other service components, enhancing the organization and development of modern learning (Khan et al.., 2022).

Web-based file management systems simplify the organization and sorting of files, providing significant benefits to faculty members and administrators by creating a well-structured repository that will aid students in accessing resources (Garrido et al., 2022). Developing a digital repository has the potential to improve research accessibility but note the significant challenge of integrating such systems across multiple institutions, which hinders their widespread adoption (Ahmad & Alammary., 2022). For instance, repository managers face significant challenges in advocating for institutional repositories, particularly in building relationships with faculty and others to encourage submissions and raise awareness of the repository's role in digital preservation. The adoption of digitization for preservation poses further challenges, as institutions must balance advanced technology with traditional library practices (Zipperer, R..,2019).

Data security is critical for organizations like educational institutions, where managing sensitive information requires robust security measures within the Management Information System, such as user authentication and data-encryption protocols to prevent unauthorized access (Nyygs et al., 2024). One of the methods is Role-Based Access Control (RBAC), which is a method for managing access permissions by assigning them to roles that users can inherit (Blundo et al.., 2020). Additionally, encryption techniques are applied to cloud storage systems, emphasizing methods that protect sensitive data from threats like unauthorized access, data breaches, and cyberattacks, ensuring confidentiality and security in cloud storage systems (Athulya, V. S., & E. D. Dileesh., 2020). Importance of data and file encryption as a defense against data infiltration and network attacks (AxCrypt., 2024 ; Cypher.dog., 2024).

Conceptual Framework

The framework is inspired by the work of Sunmola and Javahernia (2021), based on insights from a Delphi study and rigorous qualitative research, it provides a unified model that addresses essential readiness factors for deploying innovations effectively. In this framework, each element plays a critical role in creating the technological research information system, facilitating seamless management, secure storage, and easy retrieval of academic resources.

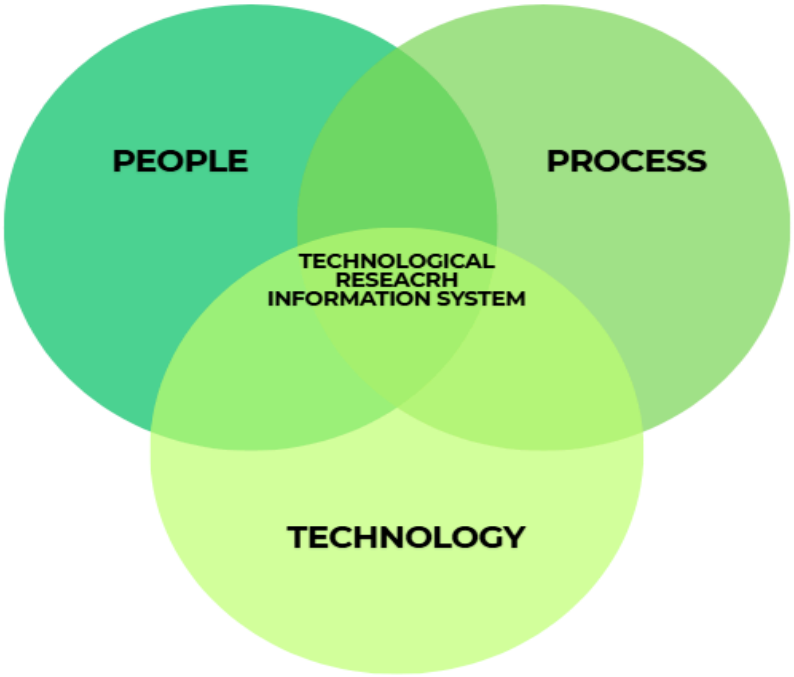

Figure 2.0: Conceptual Framework

People

The people component is a key source of information, uncovering key challenges, issues and concerns that are essential to address for the effective implementation of the Technological Research Information System model that encompasses the College of Computing and Information Sciences and College of Technology Management. It consists of users, including faculty, students, administrators, researchers and online researchers who interact with the system.

Processes

The process component established structured workflows and protocols that guide the operations of the Technological Research Information System. These workflows standardize key procedures including the data gathering or empathizing, define, ideate, developing the paper prototype, development of the system prototype, testing the prototype, and system evaluation.

Technology

The technology component is to identify and select the critical technologies necessary for the systems development.

1. Knowledge Requirements:
    1.1. Programming
    1.2. Cloud Computing
    1.3. Server management
    1.4. Multi-factor Authentication
    1.5. Data Analysis
    1.6. Documentations and Reporting
2. Software Requirements:
    2.1. VSCODE
    2.2. CodeIgniter
    2.3. PHP Development
    2.4. HTML
    2.5. CSS
    2.6. MySQL
    2.7. JavaScript
    2.8. Python
3. Hardware Requirements:
    3.1. Computer
    3.2. Server
4. Technical Specialist:
    4.1. System configuration
    4.2. Programming skills
    4.3. Web Application Development Skills

This strategic integration of knowledge, software and hardware enables the effective development of the Technological Research Information System. The core of this framework which is the TRIS brings together these three components to form a holistic, integrated solution for managing capstone projects and research. By aligning people, process and technology, the system not only ensures optimal performance but also promotes a sustainably, secure, and user-friendly repository for the proponents of the University of Makati, specifically the CCIS and CTM. This approach highlights the importance of synchronizing these three elements for achieving success, reliability, and ensuring the effective implementation of the system.

CHAPTER III

RESEARCH METHODOLOGY

This chapter discussed the researchers' study approach and steps for methodically addressing the particular issues at hand. The demographic and sampling, research instrument, data collection method, study design and procedure, and data treatment utilized for accurate information analysis and interpretation were also covered in this chapter.

RESEARCH DESIGN

This study outlines the conceptual framework for developing a Technological Research Information System (TRIS) as a repository of capstone projects and research. The research design combines the principles of design thinking with the specific context of developing and innovating the approach to contribute in addressing practical needs, ensuring usability, and fostering security and accessibility in managing academic resources aligning with the conceptual framework of our study.

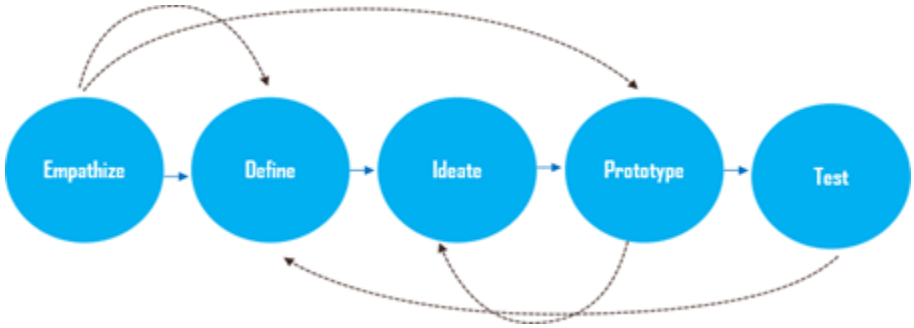

Figure 3.0: Design thinking stages. Researcher’s model (2021)

Figure 3.0 depicts the general model and strategy employed for this study. A survey and analysis using questionnaires on aspects that have caused pains to students in the process of accessing research materials were conducted. The conducted feasibility study with less than 100 respondents who are university students, administrators, and faculty who are also potential users of the Technological Research Information System, responded to the questionnaire which provide critical data necessary for understanding the users' service desirability, service feasibility, improving service feasibility, and usability problem of a system. The obtained data allowed the identification of user problems, the formulation of user personas, system features identification, and the formulation of user stories, etc. Figure 3.0 illustrates the design thinking process applied for the proposed interface design where processes of design thinking include:

Empathize

This phase involves a comprehensive exploration of the prevailing challenges and requirements within the University of Makati, specifically the data subjects which are the College of Computing and Information Sciences and College of Technology Management concerning the limited access of information of the hard copy of research materials generated by the colleges. The researcher conducted data gathering by way of interviewing the concerned personnel in the colleges. The interview provided information as to the process of managing the access of research materials.

Define

In this stage, the primary aim is to precisely articulate the key issues and obstacles confronted by the aforementioned colleges in their experience in managing the research materials effectively.

Based on the data gathered, the researchers were able to define and translate the information gathered in order to clearly define the problems.

Ideate

The Ideation phase centers around the generation of inventive concepts for the development of Technological Research Information System. The researchers identified the features and functionalities of the developed system.

Prototyping

From the ideation phase, the researchers were able to develop the paper prototype using figma in order to verify the system features and functionalities. The paper prototype was utilized to validate the feasibility from the users perspective of the features and functionalities identified by conducting a survey questionnaire. The output of the survey was used to further develop the prototype.

Test

This stage involves the systematic collection of feedback on the prototype to facilitate the refinement and enhancement of the system. The iterative testing process is crucial in ensuring the system's optimal performance.

Evaluate

Critical evaluation becomes paramount in this phase, wherein the effectiveness of the refined system is rigorously assessed. This evaluation encompasses the comprehensive testing

and assessment, taking into account factors such as user experience, system performance, and security measures. The proponent used the ISO 25010:2011 of Prabowo (2024) to evaluate the system prototype.

PROJECT DESIGN

The Technological Research Information System (TRIS) seeks to improve the management of capstone projects and thesis using cutting edge technology for a more effective and satisfactory platform. This responsive web application is targeted at improving the access, structure, and dissemination of research materials irrespective of the device in use. It targets students, faculties, administrators among other users, acting as a repository for research materials where manuscripts can be created, stored, retrieved and updated in a systematic way. In the project design for TRIS, there is a need to construct a few important system diagrams such as a Context Diagram, Use Case Diagram, Data Flow Diagram, Entity Relationship Diagram, and Network Diagram to illustrate the structure and operation of the system as a whole.

Context Diagram

Figure 3.1 illustrates the entire system, a context diagram representing the system at one function only with a clear diagram of all inputs and outputs. It is meant to exaggerate nothing by detailing all the processes because it will only serve to inundate the entities with complex details in the very first stage.

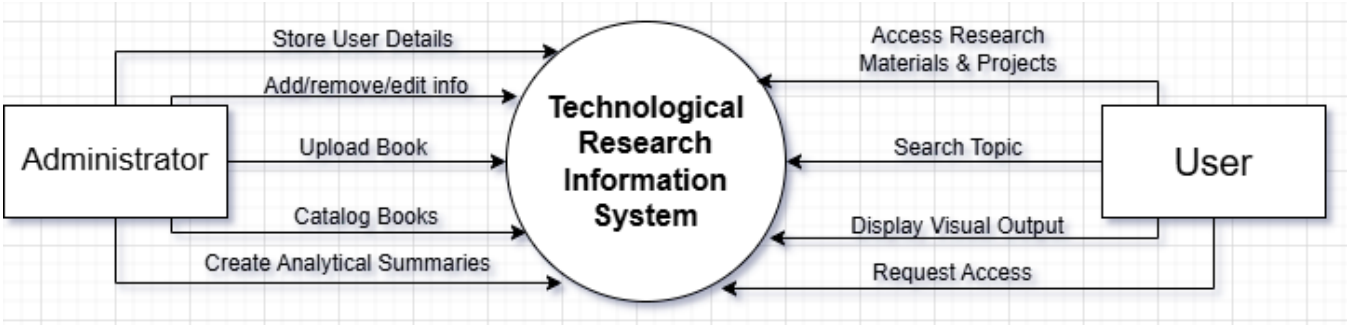

Figure 3.1: Context Diagram of TRIS

This diagram gives a basic representation of the Technological Research Information System – TRIS, demonstrating the interaction of the system and its main users. Students are allowed to file access requests and conduct research topic searches. The administrator works with the system, dealing with user access permissions, publication of research papers, and adding new content to the system. Faculty members are the ones who evaluate and give consent to the research materials posted

by the administrator. The administrator has great command and responsibility for the workings of the section, managing the user access to the section and the system itself. The system promotes an effective document control approach through the use of high-end data analysis based report generation and desktop and monitor, screen or hand held device led visual interface including a dashboard and navigation bar. The system is designed to allow students, faculty, and later other external researchers to share research materials as well as capstone project works.

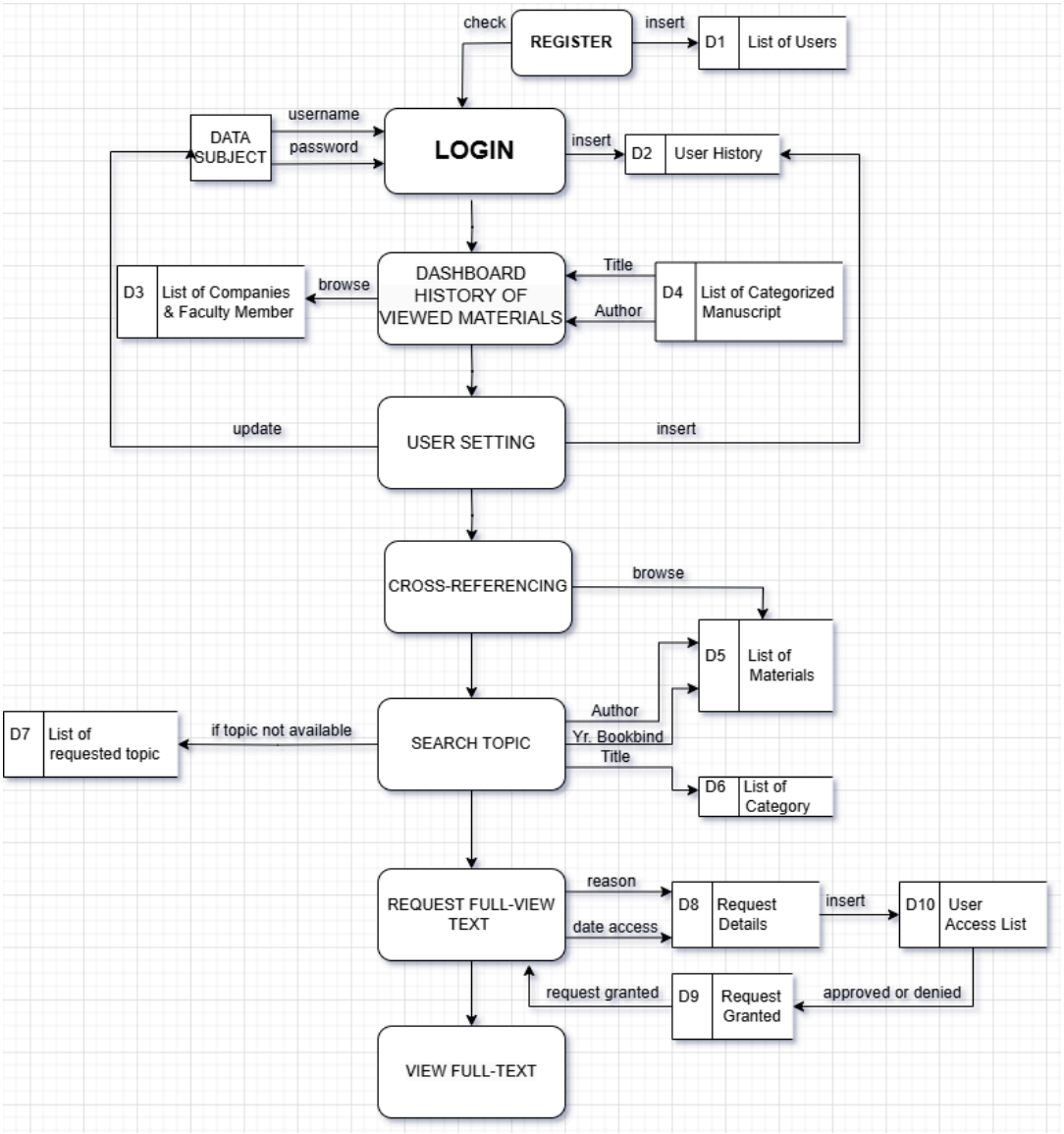

Figure 3.2. User Data Flow Diagram of TRIS

User Data flow diagram of TRIS will be discussed below:

1. System users may either log in to the system or register if they do not yet have an account on the TRIS. Subsequent to the registration, new users will undergo a multi-factor authentication system for verification purposes prior to system access.
2. Upon correct entry of the username and password, the user will be taken straight to their dashboard and will have access to the navigation bar across the system.
3. The navigation menu comprises additional elements and functions, such as searching and cross-referencing, lists of companies and academic staff, and personal account management tools, which allow connection to other pages.
4. For research materials and projects, it is necessary to obtain administrator approval before full-view access can be given. This means that until such time as an administrator grants permission, only the title, abstract, authors, adviser, and year published will be available for viewing.
5. The feedback and suggestions to new topics and categories will be beneficial to the administrators by enhancing the system's ability to supply research materials. Furthermore, the activities of the users will be supervised by the administrators.

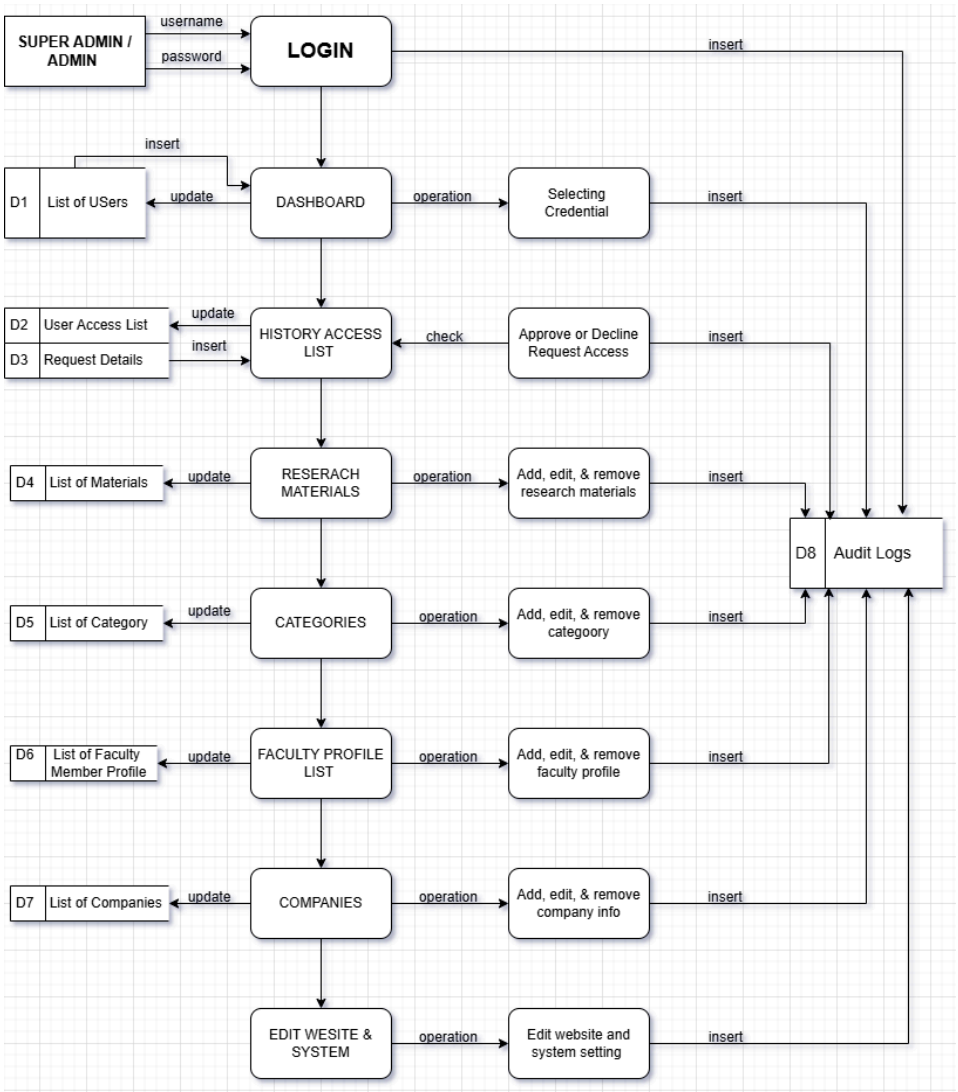

Figure 3.3. Administrator Data Flow Diagram of TRIS

Administrator Data flow diagram of TRIS will be discussed below:

1. All the control over the system is placed in the hands of the administrators. The system may be accessed by the administrator by logging in as a super admin or an admin, where credentials are required. The audit log, which is primarily for the admins attention, captures the history of all the logged in users as soon as they sign in.
2. After entering their credentials, the initial page that the administrators will come across is the dashboard, which incorporates on its left side a navigation menu to aid in accessing various pages within the system. These pages consist of a page that has a list of users alongside the provision to assign credentials to the newly registered users, as well as the management of

access request history that enables the administrators to either approve or disapprove access requests.

3. Uploading of research and capstone project materials is also the responsibility of administrators. They can add, edit and remove materials in the system. Same applies to controlling the categories. After uploading the research is prior to reviewing to publish.
4. In addition, this system also encompasses the ability to display a list of faculty members as a means of enhancing the credibility of the college through assigning technical advisors, especially for thesis projects. Supervisors are granted the rights to add, modify and delete profiles of faculty members from the system. The same functions are provided for handling the directory of the firms that partner with the institution for previous and upcoming projects.
5. Finally, administrators are required to manage the modifications of the system as well as the adjustments of the website configurations in the system as well. All actions carried out by the sited administrators are also kept in a disclosed format and hence are often referred to as the audit logs.

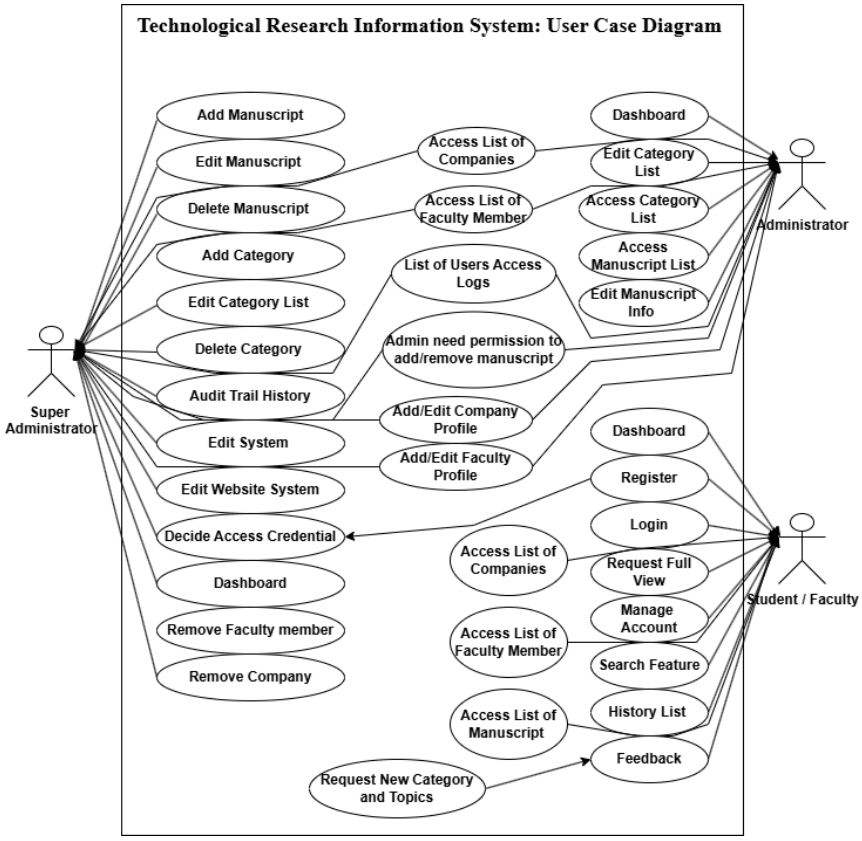

Figure 3.2: Illustration of USD Model of TRIS

A use case diagram presents the functional needs of the system in terms of the functions that each actor can perform. For instance, students can search for and upload research documents, the faculty can accept or deny those documents, while administrators can handle users and system settings. Each action or process is represented as a use case that is appropriately connected to the entities providing a good picture of how the system caters for the different users of the TRIS system.

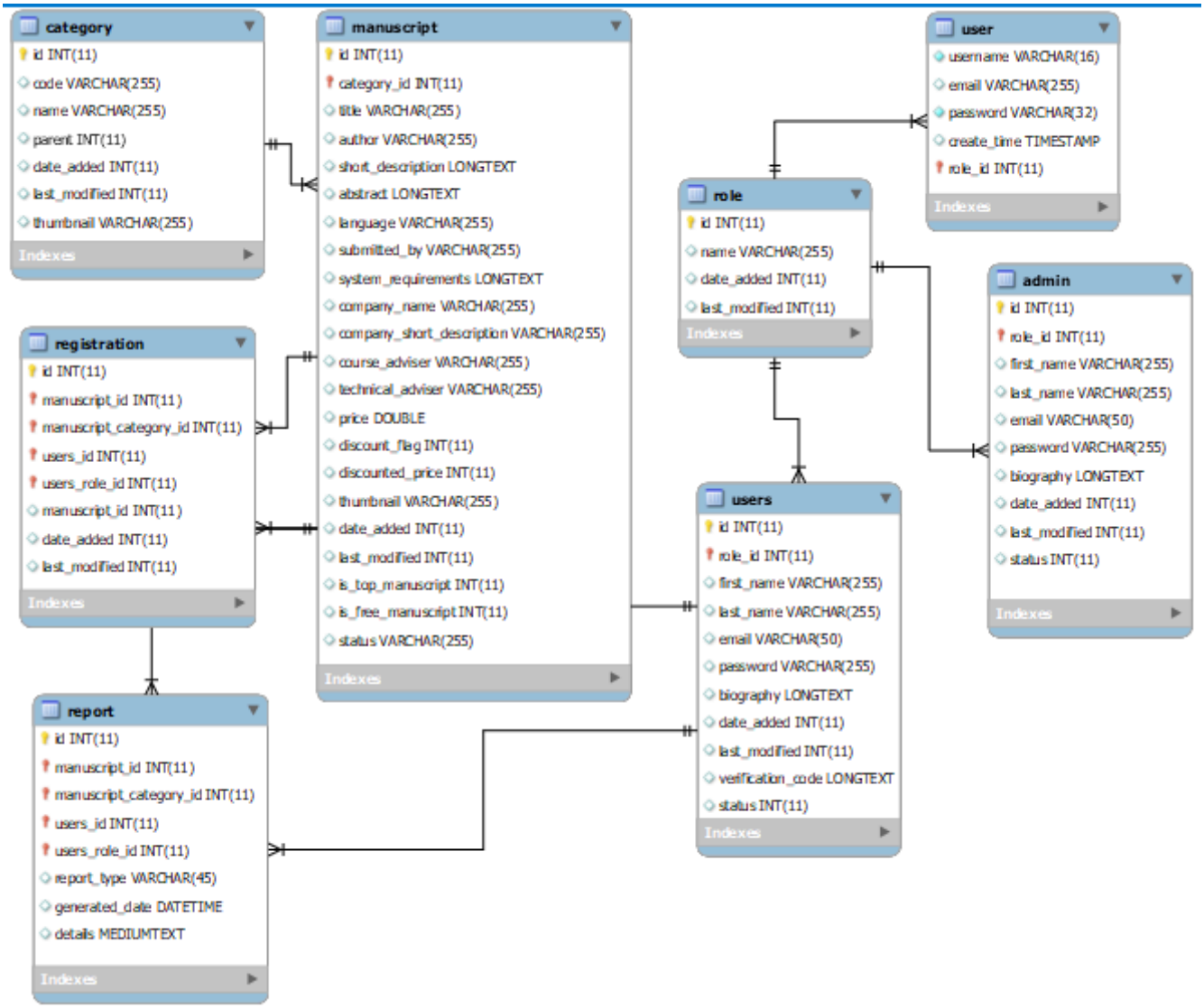

Figure 3.5: Illustration of ERD Model of TRIS

Entity-Relationship Diagram (ERD):

The ERD is a depiction of the design of the structure in the TRIS database, showing how the data entities should be depicted and how they might be related. This is a detailed blueprint outlining how a database is actually structured for the data integrity and to make access systematic and easy. It gives the developers a roadmap on how to create an efficient and well-structured database system by mapping these connections.

Virtualized Network Design

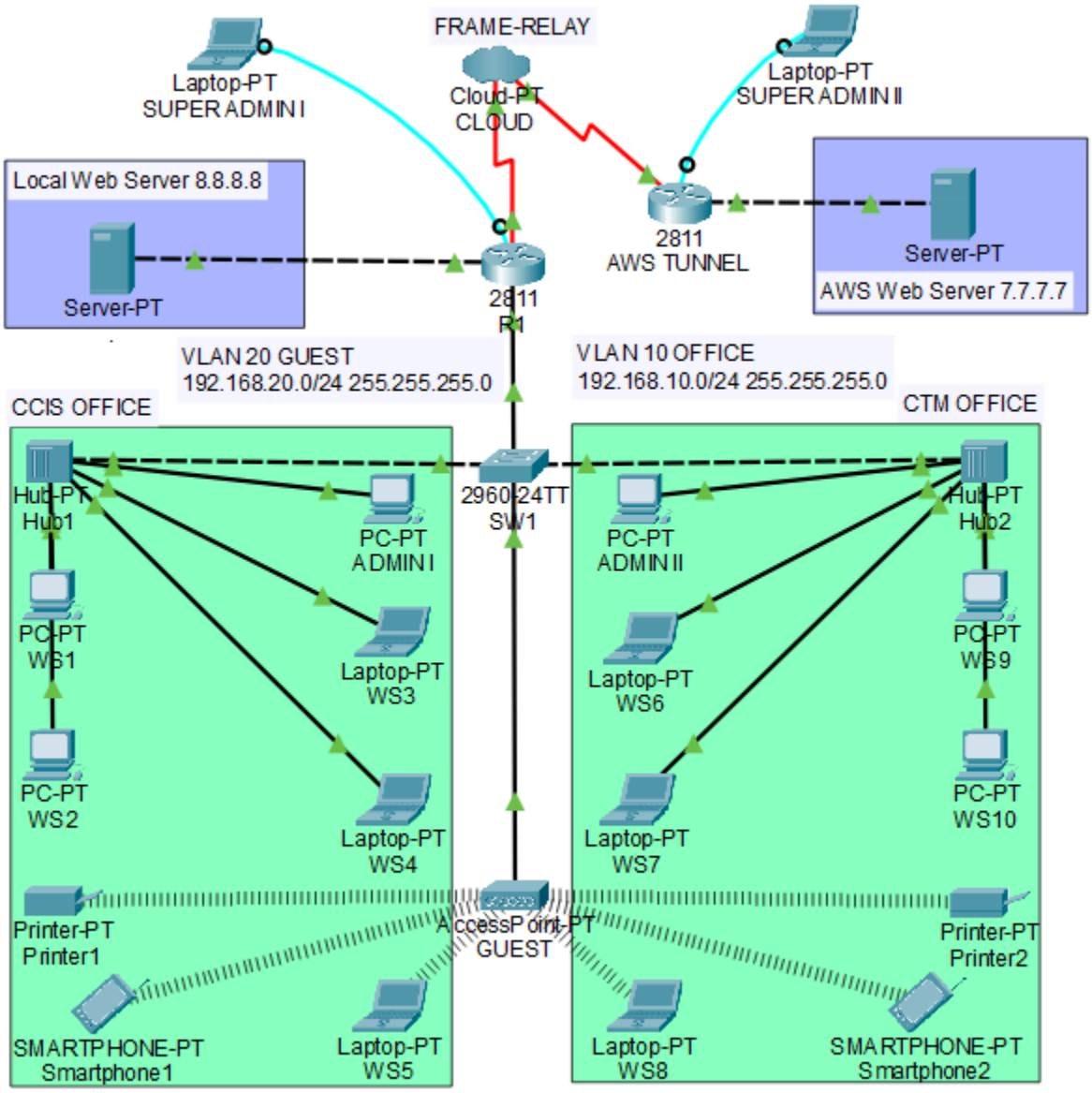

Figure 3.6 Network Design of TRIS

The Network Design Diagram:

The Network Design Diagram model in figure 2.5 displays the architecture and connectivity to the TRIS infrastructure, with an emphasis on relationships between hardware, software, and communication pathways. This allows for a visual expression of the network design of the system, representing servers, databases, and client devices in terms of how they interact. Important details

such as data flow between nodes, security layers, and scalability options are more readily apparent in this understanding of how the network will support efficient operation and safe data exchange under TRIS.

Project Development

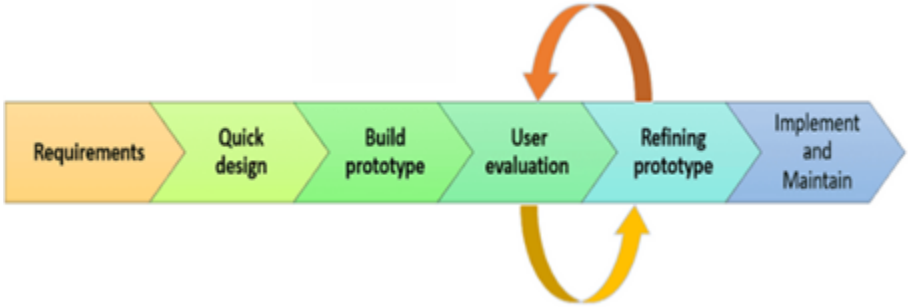

Figure 4 Evolutionary Prototyping Model (2022)

Recent studies show the advantages of the prototyping process model as stated by Dhiman (2024) The version is tested with the customer which reduces the error thoroughly.The user gets satisfied and he gets the full chance of experimenting with a partially developed system. Successful use of this model can benefit not only business results but marketing and internal operations as well. Thus the prototyping process model is employed in our study aligning with the research design approach.

According to Alao et al., (2022) Prototyping is the working replica creation of a product or system that is designed and has to be implemented. It provides a small-scale facsimile of the finished product and is used to gather customer feedback. In this model, a prototype of the end product is developed, tested, and refined based on feedback from the users until finally, an acceptable prototype is obtained that will be the basis for building the final product. It provides a better approach that saves both time and effort. Using the evolutionary prototyping approach makes room for updates as user feedback comes through as regards the proposed Technological Research Information System. As stated by Rifa'I et al. (2024) the following are the phases of prototyping:

1. Requirement Gathering and Analysis:

   The first step in developing a prototype model begins with conducting an analysis necessity. In this stage, the system requirements are defined in detail.
2. Quick Design:

   In the second stage, a simple design is created that provides a brief overview of the system to be created. The creation of a new design can be glorified once the requirements of the user are known. The next process involves creating a design based on the results of requirements gathering and analysis.
3. Build Prototype:

   After the quick design gets approval from the user, the next stage is to start building the

actual prototype. This prototype will be a guide for the programmer team in the process of creating a program or application.

4. User evaluation:

   After making the prototype, the next step is the user evaluation stage. At this stage, the system that has been created in the prototype is presented to the client for evaluation. Users provide comments and suggestions on the prototype that has been created. Compared to implementing a finished system, making a prototype allows for faster evaluation from users, providing faster feedback on good and bad designs.

5. Refining prototype:

   The refining stage is the process of improving the prototype based on client feedback at the user evaluation stage. If the user does not have a revision record of the prototype that was created, the team can proceed to the implement product and maintain stage. However, if the client has a record of improvements to the system, then the user evaluation and refining prototype stages will continue until the client approves the system to be developed

Operation and Testing Procedures

This is a detailed explanation of the procedures that are implemented prior to the implementation of the Technological Research Information System to ensure that the project meets the objectives or qualifications.

Operation Procedures

Fig. 3.1 and 3.2 shows visual representation of the sequence of processes and data flow within the system. This provides the step-by-step outline of the system's operation which will be discussed below:

Front Office:

1. User Authentication
   - User enters credentials once the email is submitted to verify if the email is valid the system will send OTP via SMS/email, after verifying the user will be prompted to create account input name and create password with the system requirements and by reading the system policy and data protection the user can now submit the validated credentials once authenticated the user can now view the manuscript they want to open.

2. Search and Access Repository
    - Users can enter search criteria and browse results, filter by year, author, or keywords. Provide feedback or rate manuscripts.
    - View aggregated ratings and comments from other users.
3. Logout and Notifications
    - Log out securely.
    - Receive notifications for updates, feedback responses, or system maintenance.

Back Office:

1. User Management
    - Administrators manage user roles and assign roles (e.g., student, faculty, admin). Add, edit, or deactivate user accounts. Monitor login and session activities.
2. Content Moderation
    - Review uploaded research materials for compliance with guidelines. Approve or reject submissions. Remove manuscript entries if necessary.
3. System Monitoring and Maintenance
    - Monitor system logs for unusual activity or errors. Backup system database.
4. Report Generation
    - Generate usage reports, research trends, and system activity summaries. Provide data for administrative decisions or performance evaluations.
5. Security Management
    - Enforce multi-factor authentication (MFA) and password policies. Monitor and respond to security threats (e.g., unauthorized access attempts). Restore backups in case of data loss or corruption.
6. Audit and Analytics
    - Review detailed logs for compliance and troubleshooting. Analyze data for insights on user behavior, popular research areas, and system efficiency.

Testing Procedures

The researcher will subject the application to the comprehensive testing which focuses on performance testing and covers system integration, security parameter improvement, and unit testing. The researcher will be conducting a user acceptability test to ensure that the application satisfies the requirements and expectations of its target audience. We hope that through this rigorous testing

process, the application will be not only technically sound but also user-friendly and reliable in various operational environments.

I. Sample

A. Testing of a new record

Primary Flow

1. The developer will provide a pre-registered account with a 16 character password, which is the Super Admin for TRIS.
2. The necessary data for the system settings can be edited by the Super Admin.
3. The assigned person for admin will register an account with 16 characters password automatically the system will give the role as user he/she is not automatically an admin just user, the Super Admin is the only one who can assign roles.
4. Upon completion of creating an account and changing roles by the super admin the user can now view the limited navigation of the system back office features.

Exceptional Flow

In the scenario where the admin credentials are already registered.

1. The system will abstain from advancing to the page of registration.

Table 5.0 Testing of the TRIS admin operator's Credential Sample

Test Case ID:	Testing01
Test Case Name:	Testing of TRIS admin Credential
Test Case Description:	To test and validate the credential of the admin
Test Case (P/F)	P
Test Case Status:	Accepted
Test Priority:	High

Table 5.0 Illustrates the testing phase for the TRIS assigned personnel as admin credential sample. It encompasses test case IDs to test priorities alongside the respective answers.

Table 5.1 Test steps in verifying the TRIS assigned admin personnel credential

TEST STEPS	
STEP	EXPECTED
1. Log into the pre-registered account of the personnel including the email and password.	The OTP input box will pop up to verify the email if it is legitimate.
2. Input of Invalid OTP	The OTP input box will pop up a message stating that the input OTP is invalid.
3. Input of Valid OTP	The OTP input box will pop up and if the OTP is valid, it will direct to the system dashboard.

Table 5.1 shows the test steps of verifying TRIS assigned personnel as admin credentials, it consists of three steps and three expected outcomes.

B. Adding a new category and manuscript in the system

Primary Flow

1. The admin shall click add a new category button to pop up the input box
2. The admin will input the appropriate name for the manuscript.
3. The admin must also input after adding parent category the sub category for specific category of the manuscript.
4. Then the admin must also add a thumbnail and icon in the input fields.
5. Click “Add” to add the category.
6. The admin shall click add a new manuscript button to pop up the input box
7. The admin will input the appropriate name for the manuscript.
8. The admin must also input necessary information for the manuscript.
9. Then the admin must also add a thumbnail and icon in the input fields.
10. Click “Add” to add the manuscript.

Table 5.3 Adding TRIS Category and Manuscript Sample

Test Case ID:	Testing02
Test Case Name:	Adding of new Category and Manuscript
Test Case Description:	To successfully add the category and manuscripts in the system
Test Case (P/F)	P
Test Case Status:	Accepted
Test Priority:	High

Table 5.3 illustrates the testing phase for the addition of manuscripts and category samples. It encompasses test case ID's progressing to test priorities, alongside their respective answers.

Table 5.4 Test Steps in adding new TRIS Category and Manuscript Sample

TEST STEPS	
STEP	EXPECTED
1. Click Add button	Input box of the adding category will appear
2. Input the necessary information of the manuscript category	The information must be filled up appropriately
3. Checking if the category will display in the category preview	The inputted category name must be displayed in the category preview
4. Click Add button	Input box of the adding manuscript will appear
5. Input the necessary information of the manuscript	The information must be filled up appropriately
6. Checking if the manuscript will display in the manuscript preview	The inputted manuscript name and details must be displayed in the manuscript preview

Table 5.4 shows the test steps of adding a new category and manuscript sample, consisting of 6 steps with their expected outcomes.

C. Testing of category preview

Primary Flow

1. The admin can check the category preview
2. The admin can view, add new categories or subcategories, edit categories, and remove categories in the system.
3. The admin can check the manuscript preview
4. The admin can view, approve manuscripts, add new manuscript, edit manuscript, and remove manuscript in the system.

Table 5.5 Testing the category and manuscript preview in the system.

Test Case ID:	Testing03
Test Case Name:	Testing of category and manuscript Preview
Test Case Description:	To test if the category and manuscript preview is working appropriately
Test Case (P/F)	P
Test Case Status:	Accepted
Test Priority:	High

Table 5.5 illustrates the testing phase for the category preview in the TRIS system. It encapasses test case IDs, progressing to test priorities alongside their respective answers.

Table 5.6 Test Steps in TRIS Category Sample

TEST STEPS	
STEP	EXPECTED
1. Testing of previewing categories also the	The previewing categories, also adding sub

adding sub categories and editing categories	categories and editing categories must be functional
1. Testing the removing of categories feature	The system must be capable of removing categories functional
2. Testing of previewing manuscript also the approving and editing manuscript	The previewing manuscript, also approving and editing manuscript must be functional
3. Testing the removing of categories feature	The system must be capable of removing manuscript functional

Table 5.6 shows the test steps of the category sample, consisting of 4 steps with their expected outcomes.

D. Checking of Database

Primary Flow

1. The admin must input their credential to access the database.
2. Check the data to see if it is recorded in the database.
3. Compare the SHA-256 if it is the same to maintain the integrity of the data.
4. Check the AES 128 record if the new file is registered as an encrypted file.

Table 5.7 Checking the database functionality

Test Case ID:	Checking01
Test Case Name:	Checking of database
Test Case Description:	To check if the data is being recorded in the database
Test Case (P/F)	P
Test Case Status:	Accepted

Test Priority:	High

Table 5.7 Illustrates the testing phase for the addition of database functionality. It encompasses test case IDs, progressing to test priorities, alongside their respective answers.

Table 5.8 Test steps for checking of database functionality sample

TEST STEPS	
STEP	EXPECTED
1. Input password	The admin must input the correct password to push through in the database
2. Checking if the SHA-256 hash key if the same	The SHA-256 hash key is the same to the file that are being compare
3. Checking of AES 128 encryption	Check if the AES 128 encryption if it is recorded in the database and if the file is already encrypted

Table 5.8 shows the test steps of checking the database functionality sample, consisting of 3 steps with their expected outcomes.

E. Checking the settings of the system.

Primary Flow

1. System setting is being displayed in the settings.
2. The admin can edit the system design and content of the system just by clicking what to edit .
3. Then the admin just needs to click “Update Setting”.

Table 5.9 Checking the database functionality sample

Test Case ID:	Checking02
Test Case Name:	Checking the settings of the system

Test Case Description:	To check if the setting of the system is functional
Test Case (P/F)	P
Test Case Status:	Accepted
Test Priority:	High

Table 5.9 Illustrates the testing phase for checking the system setting functionality. It encompasses test case IDs, progressing to test priorities, alongside their respective answers.

Table 5.10 Test steps for checking the system setting functionality sample

TEST STEPS	
STEP	EXPECTED
1. Editing the logo of the system, Banner and Banner Title	Editing the logo of the system, Banner and Banner Title must be functional
2. Editing the: about us, terms of condition, and data privacy.	Editing the: about us, terms of condition, and data privacy must be functional
3. Checking if the edits are recorded	The system must flash a message that displays system settings updated successfully and the system itself updated.

Table 5.10 shows the test steps of checking the system setting functionality sample, consisting of 3 steps with their expected outcomes.

F. Testing the responsiveness of logout.

Primary Flow

1. Click the logout button to signout the administrator.
2. Click the logout in the pop up message to confirm the logout.

Table 5.11 Testing the responsiveness of logout sample

Test Case ID:	Checking03
Test Case Name:	Checking the responsiveness of logout
Test Case Description:	To test if the logout will reflect in the system
Test Case (P/F)	P
Test Case Status:	Accepted
Test Priority:	High

Table 5.11 Illustrates the testing phase for logging out of the administrator. It encompasses test case IDs, progressing to test priorities, alongside their respective answers.

Table 5.12 Test steps in logging out sample

TEST STEPS	
STEP	EXPECTED
1. Clicking the logout button in the system	Pop up message will appear for confirmation
2. Click the logout button in the pop up message	Sign out successfully the credentials of the administrator

Table 5.12 shows the test steps of the “logging out” sample, consisting of 2 steps with their expected outcomes.

Evaluation Procedures

The evaluation procedures encompass both functional and non-functional requirements, complemented by detailed system design models. These elements collectively provide a structured approach to developing the Technological Research Information System (TRIS) effectively and efficiently. The evaluation aims to provide a comprehensive understanding of the system’s through table 2.2 which is the Nonfunctional requirements. The questionnaire, grounded using the ISO 25010, serves as the primary instrument for assessment. This method ensures a well-rounded evaluation process that considers the diverse needs and expectations of technical experts and end-users.

Table 6.0 Functional Requirement

Features	Description
User and Access Management:	Role-Based Access Control (RBAC): Ensures that user roles are clearly defined (e.g., Administrator, Faculty, Student) and that permissions align with each role. User Authentication: Requires multi-factor authentication for system access, securing sensitive information.
Research Inventory Management:	Catalog Management: Users can efficiently retrieve, add, edit, and remove capstone projects and research resources. Advanced Search and Filtering: Supports precise searches by author, title, year, keywords, and subject.
Reporting and Analytics:	Research Usage Reports: Provides insights into file access patterns, popular research topics, and overall system usage. Data Analytics: Tracks user activities, highlights research trends, and identifies frequently accessed topics.
Security and Backup:	Encryption: End-to-end SSL/TLS encryption for secure data transmission and SHA-256 hashing for password protection. Backup and Restore: Periodic backups stored in encrypted form with restricted access to administrators only.

Feedback Mechanism:	Comments and Ratings: Allows users to rate and provide feedback on research materials to guide other users in finding impactful studies.
Research Collaboration Support:	Industry Collaboration Listings: Lists companies available for research collaborations, fostering relationships between academia and industry.

Table 6.1 Nonfunctional Requirement Quality of use ISO 25010:2011

Characteristics	Sub	Statement
Effectiveness	Effectiveness	● The system is capable of processing data (show and save). ● All menus and features work well.
Efficiency	Efficiency	● The interface display (system interface) contained in the system is adequate. ● The function of each content in the application system has met the information delivery from ISO 27001. ● The function of each menu in the application can save data
Satisfaction	Usefulness	● The system can be operated easily. -Menus and information displayed can be understood easily.

	Trust	• Data security in the system can be trusted. Availability of menus in the form of instructions/help (Help) to assist users in using the system.
	Pleasure	• The system provides data and information according to user needs accurately and quickly (up to date). • The system's output (the result of data processing) is presented appropriately to facilitate user understanding. • The information provided by the system is easy to understand. The menus on the system are easy to understand without any difficulties. • The font size of the application system page can be read clearly
Freedom from risk	Economic risk mitigation	• Data on the system can only be accessed by system users. • The application system crash rate is low when the application encounters a system failure.
	Health and safety risk mitigation	• The system can search data for all the content contained in the system. • The application system is capable of tracking system usage errors.

	Environmental risk mitigation	● The program runs on frequently used operating systems. ● New users can easily use the system.
Context coverage	Context completeness	● Users easily input the data required by the system. ● The system can display the correct data according to the keywords.
	Flexibility	● The menus on the system are easy to understand without any difficulties. ● Applications have the potential to make changes and additions to software to improve services. The processes or modules in the application system are well structured to not affect other processes or modules. ● System developed with many functions.

Functional Requirements:

The functional requirements/features of the system are as shown in Table 6.0

Non-functional requirements:

For this study, the non-functional requirements of the proposed interface design that are usability principles to be used in creating the design are as shown in Table 6.1 Non- functional requirements provide functional limitations and outline how a system should behave. These specifications guarantee the system's efficiency and usefulness. For the proposed interface design, five usability principles will be considered as non-functional requirements.

Following the data gathering of feasibility study, a thorough analysis of the questionnaire responses was conducted, allowing for quantitative insights into the system’s prototype performance. A

feedback session with data subjects, including open discussions provided insight and deeper understanding of user experiences. The iterative improvement phase was initiated, guided by the identified areas for enhancement, leading to refined versions of the Technological Research Information System. The final reporting documentation encapsulated the entire evaluation process, presenting results, actions taken for improvement, and recommendations for the system.

Treatment of Data

The proposed scalable model of the Technological Research Information System project was conceptualized and developed using meticulous statistical treatment procedures, ensuring the software's quality and feasibility. The research was a questionnaire-based opinion survey. The study's questionnaire consisted of closed-ended questions answered on a five-point Likert scale. To determine their thoughts, the data subjects had to choose between 1 to 5 rating the system prototype.

Table 7.0 Likert Scale

Scale	Verbal Interpretation	Mean Rating Score
5	Strongly Agree	4.51 - 5.00
4	Agree	3.51 - 4.50
3	Neutral	2.51 - 3.50
2	Disagree	1.51 - 2.50
1	Strongly Disagree	1.00 - 1.50

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