

UNIVERSITI TEKNOLOGI MARA

**ASSESSING THE STATE OF
PAHANG LIBRARIAN
PERSPECTIVES AND USER
SATISFACTION ON DIGITAL
TECHNOLOGY SUSTAINABILITY
IN THE RURAL PUBLIC LIBRARY**

MOHD HAFIDZRIL BIN MANSOR

MSc

June 2026

UNIVERSITI TEKNOLOGI MARA

**ASSESSING THE STATE OF
PAHANG LIBRARIAN
PERSPECTIVES AND USER
SATISFACTION ON DIGITAL
TECHNOLOGY SUSTAINABILITY
IN THE RURAL PUBLIC LIBRARY**

MOHD HAFIDZRIL BIN MANSOR

Thesis submitted in fulfilment
of the requirements for the degree of
Master of Science
(Information Management)

Faculty of Information Science

June 2026

CONFIRMATION BY PANEL OF EXAMINERS

I certify that a Panel of Examiners has met on 20 August 2025 to conduct the final examination of Mohd Mohd Hafidzrizal Bin Mansor on his Masters of Science thesis entitled “Assessing the State of Pahang Librarian Perspectives and User Satisfaction on Digital Technology Sustainability in the Rural Public Library” in accordance with Universiti Teknologi MARA Act 1976 (Akta 173). The Panel of Examiners recommends that the student be awarded the relevant degree. The Panel of Examiners was as follows:

Irwan Kamaruddin Abd Kadir, PhD
Associate Professor
Faculty of Information Science
Universiti Teknologi MARA
(Chairman)

Siti Khairunnisa Sheikh Abdul Mutalib, PhD
Senior Lecturer
Faculty of Information Science Universiti
Teknologi MARA
(Internal Examiner)

Yanti Idaya Aspura Mohd Khalid, PhD
Associate Professor
Faculty of Arts and Social Sciences
University Malaya
(External Examiner)

PROFESSOR DR HJH ZURAEDA IBRAHIM
Dean
Institute of Postgraduates Studies
Universiti Teknologi MARA

Date: 8 June 2026

AUTHOR’S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

Name of Student : Mohd Hafidzrizal Bin Mansor

Student ID. No. : 2022432502

Programme : Master of Science (Information Management) –
CDIM750

Faculty : Information Science

Thesis Title : Assessing the State of Pahang Librarian Perspectives
and User Satisfaction on Digital Technology
Sustainability in the Rural Public Library

Signature of Student :

Date : June 2026

ABSTRACT

This study examines the sustainability of digital technology implementation in rural public libraries (RPLs) in Pahang, Malaysia. By integrating librarian perspective with user satisfaction analysis. Despite national initiatives such as Perpustakaan Desa and MYDIGITAL Blueprint aimed at enhancing information access in rural communities, persistent challenges remain, including infrastructural limitations, insufficient funding, low public awareness and concerns regarding long-term viability. Employing an exploratory sequential mixed-methods design, the study began with semi-structured interviews with librarians to identify key development of a questionnaire, adapted from established measurement models and validated by the National Library of Malaysia (PNM), which was subsequently administered to 2,660 RPL users. Quantitative analysis using Partial Least Squares Structural Equation Modelling (PLS- SEM) revealed that technology awareness and usage significantly influence digital sustainability outcomes, with user satisfaction functioning as a mediating variable. The results underscore the necessity of aligning institutional strategies with user needs to enhance service effectiveness and sustainability. This study contributes a holistic conceptual framework for evaluating digital technology sustainability with rural library contexts and offers evidence-based recommendations to support the implementation of Malaysia's national digital transformation initiatives.

ACKNOWLEDGEMENT

First and foremost, I want to thank Allah SWT for the grace that allowed me to start my Master's journey and for helping me successfully finish this difficult and protracted journey. The completion of this thesis would not have been possible without the excellent advice, support, and patience of my supervisor, Assoc. Prof. Ts. Dr. Roziya Abu, and Dr. Siti Khadijah binti Rafie. I am really blessed to have them as my mentor because of their helpful criticism, knowledge, commitment, and desire to share what they know.

I am grateful to the Postgraduate and Professional Studies department for providing the facilities, administrative support, resources, and help. I would especially like to thank my friends and colleagues for their help with this research. Their guidance and support have been tremendous, making the process more enjoyable and manageable. The foundation of my development has been the mutual support and experiences we have shared.

I also want to express my sincere gratitude to my family, who have been my strongest supporters during this journey. Their steadfast faith in me and their ongoing encouragement to pursue greatness have been a tremendous source of inspiration. They have served as a reminder to me to remain strong in the face of adversity and to never give up, no matter how difficult things get. I am sincerely appreciative of her valued presence in my life, and the immense support she has provided has been invaluable during this path.

In conclusion, this thesis is dedicated to my brother, Mohd Hafidzie bin Mansor, whose vision and commitment to education have served as the foundation for all my accomplishments. Everything I have achieved is a direct result of their love, support, and sacrifice. I dedicate this triumph to every one of you.

Alhamdulillah.

TABLE OF CONTENTS

	Page
CONFIRMATION BY PANEL OF EXAMINERS	ii
AUTHOR’S DECLARATION	iii
ABSTRACT	iv
ACKNOWLEDGEMENT	v
TABLE OF CONTENTS	vi
LIST OF TABLES	x
LIST OF FIGURES	xii
LIST OF ABBREVIATIONS	xiii
CHAPTER 1 INTRODUCTION	1
1.1 Introduction	1
1.2 Background of Research	2
1.2.1 Malaysian Public Library	2
1.2.2 Pahang State Rural Library	3
1.2.3 Digital Technology Sustainability and Libraries	4
1.3 Problem Statement	5
1.3.1 Digital Divide in Rural Communities	6
1.3.2 Sustainability of Digital Technology in Rural Public Libraries	7
1.3.3 Impact on User Satisfaction	8
1.4 Purpose of Study	10
1.5 Research Objectives	10
1.6 Research Questions	10
1.7 Operational Definitions	11
1.7.1 Rural Public Library	11
1.7.2 Digital Technology	11
1.7.3 Sustainability	11
1.7.4 Librarian and Information Professional	12
1.7.5 Library Users	12

1.8	Scope Of Study	12
1.9	Significance Of Study	13
1.9.1	Theoretical Contributions	13
1.9.2	Practical Implications	14
1.9.3	Societal Impacts	14
1.10	Summary Of Chapter	14
CHAPTER 2 LITERATURE REVIEW		16
2.1	Introduction	16
2.2	Basic Principle and Concept of the Study	17
2.2.1	Librarian Role	17
2.2.2	Library User Satisfaction	18
2.2.3	Digital Technology	21
2.2.4	Sustainability	22
2.2.5	Digital Technology Sustainability	24
2.3	Library Digital Technology Sustainability Plan in Malaysia	26
2.4	Previous Theories and Model: Qualitative Research	27
2.4.1	Thematic Analysis	28
2.5	Previous Theories and Model: Quantitative Research	31
2.5.1	The DeLone and McLean Information Systems (IS) Success Model	32
2.5.2	The Diffusion of Innovation	35
2.5.3	The Three Pillars of Sustainability Framework	37
2.5.4	IASAM Model	40
2.6	Literature Gaps	42
2.7	Development of Conceptual Framework	44
2.7.1	Discussion on Conceptual Framework of Librarian Perspectives and User Satisfaction on Digital Technology Sustainability in the Rural Public Library	44
2.7.2	Hypotheses	47
2.8	Summary of Chapter	48
CHAPTER 3 RESEARCH METHODOLOGY		50
3.1	Introduction	50
3.2	Design of Research	50

3.2.1	Type of Research	51
3.2.2	Research Paradigm	53
3.2.3	Research Process	54
3.3	Population and Sampling	56
3.3.1	Population	56
3.3.2	Sampling	57
3.4	Sampling Criteria	59
3.4.1	Inclusion Criteria	60
3.4.2	Exclusion Criteria	60
3.5	Instrument Development	61
3.5.1	Interview Guide Developments	61
3.5.2	Questionnaire Developments	62
3.5.3	National Library Expert Approval	65
3.6	Pre-Test (National Library Expert Approval)	65
3.7	Reliability of the Instrument: Pilot Study	67
3.8	Data Collection and Analysis Technique	68
3.8.1	Data Collection	68
3.8.2	Data Analysis	68
3.9	Ethical Approval	69
3.9.1	UiTM Approval	70
3.9.2	National Library Approval	70
3.10	Summary of Chapter	71
CHAPTER 4 DATA ANALYSIS AND FINDINGS		72
4.1	Introduction	72
4.2	Demographic Background of Respondents (Librarian and Library User)	72
4.2.1	Gender	72
4.2.2	Age	74
4.3	First Phases: Qualitative Data Analysis	74
4.3.1	Digital Literacy Program	76
4.3.2	Collaboration and Partnership	81
4.3.3	Community Engagement	84
4.4	Second Phases: Quantitative Data Analysis	87

4.4.1	Data Preparation and Cleaning	87
4.4.2	Common Method Bias	88
4.4.3	Response Rate (Library User 42 Respondents for Each Zone)	89
4.4.4	Descriptive Analysis	89
4.4.5	Result of PLS Measurement: Inferential Statistic	94
4.4.6	Normality Test Results	99
4.4.7	Hypothesis Testing	99
4.5	Summary of Chapter	101
CHAPTER 5 CONCLUSION		103
5.1	Introduction	103
5.2	Discussion of the Themes: Qualitative Research	103
5.2.1	Digital Literacy	103
5.2.2	Collaboration and Partnership	104
5.2.3	Community Engagement	104
5.3	Discussion of the Themes: Quantitative Research	105
5.3.1	Technology Awareness and Usage	105
5.3.2	User Satisfaction	105
5.3.3	Rural Public Library Sustainability	105
5.4	Discussion Based on Hypotheses	106
5.5	Mapping the Results Based on Hypotheses	107
5.5.1	To Investigate the Current State of Digital Technology Availability to Enhance the User Satisfaction Towards Rural Public Library Sustainability	107
5.5.2	To Examine Technology Awareness and Usage Influence the Rural Public Library Digital Technology Sustainability.	107
5.5.3	To Examine the Mediating Role of User Satisfaction Towards Rural Public Library Digital Technology Sustainability.	108
5.6	Recommendations	109
5.6.1	Future Research	110
5.7	Conclusion	111
REFERENCES		113
APPENDICES		116
AUTHOR'S PROFILE		122

LIST OF TABLES

Tables	Title	Page
Table 2.1	Steps Taken for Thematic Analysis	28
Table 2.2	Digital Literacy Key Findings	30
Table 2.3	Partnerships Key Findings	30
Table 2.4	Community Engagement Key Findings	30
Table 2.5	Benefits of the DeLone and McLean IS Success Model in Evaluating Digital Technology in Rural Public Libraries	33
Table 2.6	Technology and Innovation	39
Table 2.7	Law and Governance	39
Table 2.8	Economic and Financial Incentives	40
Table 3.1	Number of Sample	58
Table 3.2	Interview Guide for Digital Literacy Programs, Collaboration and Partnership, and Community Engagement	62
Table 3.3	Questionnaire Development for Technology Awareness and Usage	64
Table 3.4	Questionnaire Development for User Satisfaction	64
Table 3.5	Questionnaire Development for Digital Technology Sustainability	65
Table 3.6	Reliability of Instrument Measures Based on Pilot Study	67
Table 3.7	Ethical Considerations for This Research	70
Table 4.1	Gender of Librarians Who Participated in This Study	73
Table 4.2	Gender for Library Users	73
Table 4.3	Age of Respondents	74
Table 4.4	Indicators That Indicate the Librarians Who Participated in This Study	74
Table 4.5	Total Variance Explained	88
Table 4.6	Number of Librarians and Users	89
Table 4.7	Overall Result of Mean for Technology Awareness and Usage	90

Table 4.8	Result of Mean for Technology Awareness and Usage	91
Table 4.9	Overall Result of Mean for User Satisfaction	92
Table 4.10	Result of Mean for User Satisfaction	92
Table 4.11	Overall Result of Mean for Digital Technology Sustainability	93
Table 4.12	Result of Mean for Digital Technology Sustainability	94
Table 4.13	Direct Effect Between Technology Awareness and Usage with Rural Public Library Digital Technology Sustainability	95
Table 4.14	Special Indirect Effect on the Role of User Satisfaction as Mediating with Technology Awareness and Usage Towards Rural Public Library Digital Technology Sustainability	97
Table 4.15	Combined Direct and Indirect Effects of Technology Awareness and Usage Influence the Rural Public Library Digital Technology Sustainability	98

LIST OF FIGURES

Figures	Title	Page
Figure 2.1	The Sustainable Development Goals (United Nations)	23
Figure 2.2	DeLone and Mclean IS Success Model	33
Figure 2.3	DOI Model	36
Figure 2.4	Three Pillars of Sustainability Framework	38
Figure 2.5	IASAM Model	41
Figure 2.6	Conceptual Framework of Librarian Perspectives and User Satisfaction on Digital Technological Sustainability in the Rural Public Library	45
Figure 3.1	Basic Mixed Methods Research Design	55
Figure 3.2	The Number of Populations in Pahang state	57
Figure 3.3	Sample Size Calculator	59
Figure 3.4	Lists of personnel given by National Library of Malaysia	66
Figure 4.1	Bootstrapping Path Model to Show the Relationship Between the Variables	99

LIST OF ABBREVIATIONS

Abbreviations

AGM	Reading Encouragement Activity
ALA	American Library Association
DMIS	The DeLone and McLean Information Systems (IS) Success
DOI	Diffusion Of Innovation
E-LMM	Media and Information Literacy Self-Learning System
IASAM	Integrated Acceptance & Sustainability Assessment Model
ICT	Information and Communication Technology
IFLA	International Federation of Library Associations and Institutions
IMLS	Institute of Museum & Library Services
ISSM	Information Systems Success Model
MIS	Management Information Management
MLM	Malaysian Library Management
MYDigital	Malaysia Digital Economy Blueprint
PEDI	Digital Economy Centre

CHAPTER 1

INTRODUCTION

1.1 Introduction

Digital technology has played a pivotal role in the modernization of public libraries across the globe in recent years, converting them from conventional book repositories to community centers for digital literacy, lifelong learning, and information access. Public libraries are particularly crucial in bridging the digital divide between rural and urban communities in Malaysia. In Pahang, the biggest state in Peninsular Malaysia, where many rural areas still struggle with issues including poor digital literacy, restricted access to high-speed internet, and inadequate infrastructure, this duty is crucial (Horrigan, 2023; Hashim & Ismail, 2023). Therefore, Pahang's Rural Public Libraries (RPLs), which provide internet access, e-resources, and digital learning initiatives, have emerged as crucial gateways for digital inclusion.

The sustainability of digital services in RPLs is still inconsistent, despite government initiatives like Perpustakaan Desa and the MyDIGITAL Blueprint (Economic Planning Unit, 2021; National Library of Malaysia, 2022). Maintaining modern technology, guaranteeing dependable internet connectivity, and obtaining funds for digital projects are challenges faced by many Pahang rural libraries (Johnson & Griffis, 2022). These issues affect users, who depend on libraries as their main source of digital access, as well as librarians, who are responsible for overseeing and maintaining these services. Research conducted in Malaysia has revealed that although user satisfaction has been extensively studied (Islam & Ahmed, 2020; Yusof & Rahman, 2022), librarians' viewpoints have received far less attention. However, despite their difficulties, librarians play a crucial role in the adoption, promotion, and maintenance of digital technology.

Furthermore, one of the main concerns is awareness of the digital services that are available. According to research, under-utilization and decreased sustainability result from both librarians and users in rural settings frequently not being sufficiently aware of digital initiatives (Rahman & Lim, 2022; Park & Lee, 2020). Policy initiatives run the risk of ignoring the crucial elements that affect the long-term sustainability of

digital services in rural libraries if awareness, utilization, and satisfaction are not understood in relation to sustainability.

Thus, this study especially examines the sustainability of digital technology from the viewpoints of both librarians and consumers, concentrating on Pahang's rural public libraries. The goal of this research is to offer a more comprehensive knowledge of the sustainability difficulties in RPLs by looking at digital technology availability, awareness, utilization, and user satisfaction in addition to librarians' professional experiences. up addition to filling up current research gaps, the study offers evidence-based suggestions that help improve rural library services and further Malaysia's larger objective of achieving an equitable digital transformation.

1.2 Background of Research

In an era dominated by rapid technological advancements, public libraries have evolved from traditional repositories of books to dynamic hubs of digital knowledge and community engagement. This transformation is particularly critical for rural libraries, which serve as essential access points for education, information, and digital literacy in underserved communities. However, rural public libraries, such as those in Pahang, Malaysia, often face significant challenges in adopting and sustaining digital technologies, including limited funding, inadequate infrastructure, and low awareness among users. These barriers hinder their ability to provide equitable access to digital resources and meet the evolving needs of their communities. Against this backdrop, this study seeks to explore the state of digital technology sustainability in Pahang's rural public libraries, focusing on the perspectives of librarians and the satisfaction levels of users. By addressing these issues, the research aims to contribute to the development of strategies that enhance the role of rural libraries in bridging the digital divide and fostering sustainable community development.

1.2.1 Malaysian Public Library

The role of public libraries has evolved significantly in the digital age, with these institutions now serving as critical access points for digital technology, particularly in undeserved rural areas. Traditionally, public libraries have been central to community life, providing access to books, educational programs, and community services. In rural

communities, where access to educational resources and technology is often limited, public libraries have become even more vital. They offer not only traditional library services but also access to digital resources, including internet services, digital literacy programs, and e- government services (Bertot et al., 2019). This evolution in the role of libraries has necessitated a focus on the sustainability of these digital services, especially in rural contexts where resources may be scarce (Maness, 2021).

Public libraries in Malaysia play a vital role in promoting literacy, education, and access to information for all citizens, including those in rural areas. The National Library of Malaysia (Perpustakaan Negara Malaysia) oversees the development and management of public libraries across the country, ensuring they serve as community hubs for knowledge and learning. However, rural public libraries often face unique challenges, such as limited funding, inadequate infrastructure, and lower access to digital technologies compared to urban libraries. Despite these challenges, rural libraries are essential for bridging the digital divide and providing equitable access to information for underserved communities. In recent years, there has been a growing emphasis on transforming rural libraries into digital learning centers, but the progress and sustainability of these initiatives remain uneven across different states, including Pahang.

1.2.2 Pahang State Rural Library

Pahang, the largest state in Peninsular Malaysia, has a diverse population spread across urban and rural areas. The Pahang State Public Library (Perpustakaan Awam Pahang) is responsible for managing public libraries within the state, including those in rural regions. These libraries serve as critical access points for education, information, and community development. However, rural libraries in Pahang face significant challenges, such as limited internet connectivity, outdated technology, and a lack of digital resources. While efforts have been made to modernize these libraries, the adoption and sustainability of digital technologies remain inconsistent. Understanding the current state of digital technology in Pahang's rural libraries, as well as the perspectives of librarians and users, is crucial for identifying gaps and improving their effectiveness in the digital age.

Generally, Rural communities around the world have historically faced challenges in accessing the same level of infrastructure and services as their urban counterparts, particularly in the realm of digital technology. Limited access to high-speed internet, fewer educational resources, and geographical isolation contribute to a digital divide that can hinder the socioeconomic development of these areas (Park & Lee, 2020). Public libraries in rural communities have emerged as crucial institutions in bridging this divide, providing not only access to information and education but also to essential digital resources. However, the effectiveness of these efforts depends on the sustainability of the digital technologies offered, which can be threatened by financial constraints, inadequate infrastructure, and a lack of trained personnel (Johnson & Griffis, 2022).

1.2.3 Digital Technology Sustainability and Libraries

Digital technology has become an essential component of modern public libraries, enabling them to provide a wide range of services that go beyond traditional book lending. In rural areas, where access to technology is often limited, public libraries play a crucial role in bridging the digital divide. However, the sustainability of digital technology in rural public libraries is a pressing concern. Sustainability in this context refers to the library's ability to maintain and update its digital resources over time, ensuring that these services remain relevant and accessible to the community (Maness, 2021). Achieving sustainability is particularly challenging in rural areas, where libraries often face financial constraints, limited infrastructure, and a shortage of trained staff.

One of the key factors influencing the sustainability of digital technology in rural public libraries is funding. Unlike their urban counterparts, rural libraries frequently operate with smaller budgets, which can limit their ability to invest in and maintain up-to-date technology (Horrigan, 2019). Inconsistent or inadequate funding can lead to outdated equipment, slow internet connections, and a lack of digital literacy programs, all of which can negatively impact user's satisfaction and the library's ability to serve its community effectively (Johnson & Griffis, 2022). To address these challenges, some rural libraries have sought alternative funding sources, such as grants and partnerships, to support their digital initiatives. However, securing long-term funding remains a significant hurdle.

Another critical aspect of digital technology sustainability in rural public libraries is the availability of skilled personnel. The rapid pace of technological change requires that library staff possess the necessary skills to manage, troubleshoot, and teach digital technologies. Unfortunately, rural libraries often struggle to attract and retain qualified staff due to geographic isolation and limited resources for professional development (Park & Lee, 2020). This skills gap can hinder the library's ability to offer comprehensive digital services, thereby affecting the overall sustainability of these services. Investing in ongoing training and professional development for library staff is essential to ensure that they can effectively support and sustain digital technology in their libraries (Bertot et al., 2019).

1.3 Problem Statement

Despite sustained national efforts through initiatives such as Perpustakaan Desa and the MYDIGITAL Blueprint, rural public libraries (RPLs) in Malaysia—particularly in the state of Pahang, continue to encounter persistent challenges in sustaining digital technology services (Economic Planning Unit, 2021; National Library of Malaysia, 2022). These libraries are intended to function as community digital hubs by providing internet access, digital resources and literacy training to bridge the digital divide between rural and urban populations (Bertot et al., Marness, 2021). However, their effectiveness remains constrained by fundamental limitations, including outdated technological infrastructure, unusable internet connectivity and inadequate financial support (Horrigab, 2023; Johnson & Griffs, 2022). These barriers weaken the capacity of RPL's to deliver consistent digital services and threaten the long-term sustainability of technology-based initiatives in rural communities.

Although previous studies in Malaysia have examined user satisfaction and accessibility of digital resources within public libraries (Islam & Ahmed, 2020; Yusof & Rahman, 2022), research addressing librarian's perspectives remain scarce. Librarians play a critical role in the implementation, maintenance and promotion of digital services. Yet, their professional challenges, including insufficient training, limited technical support and difficulties in user outreach are insufficiently explored (Abdullah & Kassim, 2019; Hashim & Ismail, 2023). Furthermore, disparities in awareness levels among both librarians and users contribute to underutilized of available digital platforms, thereby reducing the sustainability potential of these

technologies (Rahman & Lim, 2022; Park & Lee, 2020). The lack of integrated analysis that links operational perspectives with user experiences represents an important gap in existing literature.

This research gap is particularly significant in Pahang, which hosts one of the largest networks of rural public libraries in Peninsular Malaysia (PSLC, 2023). While modernization initiatives continue to be implemented, empirical evidence remains limited regarding how librarians assess the sustainability of digital services in comparison with user satisfaction outcomes. Without synthesizing both viewpoints, existing evaluations of digital sustainability remain fragmented and incomplete. Addressing this knowledge gap is essential to formulating holistic strategies that enhance service delivery, improve technology adaptation and strengthen the role of RPL's as sustainable access centers for underserved populations (Hassan & Ismail, 2023; Library Journal, 2022). Accordingly, this study critically examines the combined influence of librarian perspectives and user satisfaction on digital technology sustainability in rural public libraries across Pahang, with specific emphasis on the mediating roles of awareness and usage behavior.

1.3.1 Digital Divide in Rural Communities

The digital divide defined as unequal access to digital technologies, internet connectivity and digital literacy, continues to pose a significant barrier to socioeconomic development in Malaysia's rural regions. Although the government has introduced initiatives such as JENDELA, Perpustakaan Desa and MyDIGITAL Blueprint to strengthen nationwide digital inclusion, rural communities still lag behind urban populations in terms of connectivity and technological readiness. According to the Malaysian Communications and Multimedia Commission (MCMC, 2022), rural broadband penetration remains considerably lower, with many villages in states such as Pahang experiencing inconsistent speeds below the national average. Geographic dispersion, low population density, and high infrastructure costs contribute to these persistent challenges, making rural areas less commercially attractive for private telecommunications investment.

The digital disparity has direct consequences for rural communities, affecting access to online education, e-government services, health, digital banking and employment opportunities. The Department of Statistics Malaysia (DOSM, 2022)

reports that rural households exhibit significantly lower digital literacy rates, with only 47% demonstrating basic ICT competency compared to 71% in urban areas. These gaps reinforce broader inequalities and limit rural communities' ability to participate fully in Malaysia's digital transformation agenda.

Rural public libraries (RPL's) are positioned as key community access points to bridge this divide by offering internet access, computer facilities and digital learning programs. In many rural areas of Pahang, RPL function as the primary or in some cases, the only digital hubs available to residents. However, despite their strategic role, these libraries face obstacles that hinder their capacity to deliver sustainable digital services. Challenges include limited funding for equipment upgrades, outdated computer terminals, unstable WI-FI connectivity and insufficiently trained staff to support digital technology use (National Library of Malaysia, 2022). Such constraints weaken the libraries' ability to meet growing community demand for digital services.

Evidence from Malaysia further highlights the severity of these challenges. A Pahang Library Corporation (PSLC,2023) report notes that several rural libraries operate with minimal ICT resources, with less than five functioning computers available for public use in many branches. MCMC's 2021 network audit also revealed that numerous rural library locations fall within areas classified as having "Limited or no 4G coverage," directly restricting the reliability of library based digital services. These structural limitations not only reduce service quality but also contribute to under-utilization, undermining the long-term sustainability of digital initiatives.

In summary, although rural public libraries are vital in narrowing the digital divide, persistent limitations in infrastructure, connectivity and digital readiness continue to impede their effectiveness. Strengthening technological capacity in rural libraries, particularly in high-need states like Pahang. It is essential to ensuring equitable access to digital opportunities and enabling libraries to serve as sustainable, transformation digital hubs for rural communities.

1.3.2 Sustainability of Digital Technology in Rural Public Libraries

The sustainability of digital technology in rural public libraries (RPLs) is closely tied to their ability to maintain, upgrade and effectively utilize technological resources over time. However, many rural libraries in Malaysia operate under constrained budgets that limit their capacity to procure new equipment, replace aging infrastructure or

expand digital services. The National Library of Malaysia (2022) highlights that rural branches often receive smaller allocations compared to urban libraries, affecting their ability to sustain modern digital facilities. This financial pressure restricts their readiness to support Malaysia's MyDIGITAL agenda and undermines long-term efforts to create equitable digital access for rural communities.

Infrastructure limitations further threaten the sustainability of digital initiatives. Many rural libraries in states such as Pahang occupy older buildings not designed to support high-speed internet, secure wiring or advanced computer systems, making technological upgrades costly and often delayed. MCMC's 2022 network coverage assessment indicates that several rural zones in Pahang continue to experience unstable or low-speed broadband, reducing functional value of library-based digital technology even when hardware, upgrades are attempted. These structural constraints create a cyclical problem: technology becomes outdated faster than it can be replaced, while poor connectivity discourages user engagement and lowers satisfaction with digital services.

A shortage of trained personnel also weakens digital sustainability in rural public libraries. Effective operation of digital services requires staff with adequate ICT proficiency, yet rural librarians frequently limited access to training, technical support and professional development opportunities (PSLC, 2023). This affects their ability to troubleshoot issues, promote digital programs or provide meaningful user assistance. The rapid pace of technological advancement intensifies these challenges as continuous updates and system changes require ongoing skills. Without sufficient funding, infrastructure readiness and human resource capacity, rural public libraries struggle to maintain sustainable digital services, diminishing their potential to act as long-term digital access hubs for underserved communities.

1.3.3 Impact on User Satisfaction

User satisfaction is a critical measure of the effectiveness of digital technology services in rural public libraries (RPL's), particularly in states such as Pahang where many communities depend on libraries as their primary point of digital access. When digital services such as internet connectivity, computer access and online learning platforms function effectively, users are more likely to engage with the library and perceive it as a valuable community resource. However, inconsistencies in service

quality frequently affect user experience in rural Malaysia. According to the National Library of Malaysia (2022), many rural library users report difficulties accessing reliable internet or finding sufficient computer facilities, suggesting that digital services often fail to meet user expectations. Such limitations reduce satisfaction and weaken the perceived relevance of the library's functions.

A major determinant of user satisfaction is the reliability and quality of the digital infrastructure available within rural libraries. Slow or unstable internet connections, outdated hardware and limited technical support create barriers that directly influence how users perceive technology-based services.

MCMC's 2022 JENDELA progress update highlighted that several rural districts in Pahang still experience broadband speeds significantly below the national average, affecting a library's ability to deliver efficient digital access. Users who encounter repeated connectivity issues or malfunctioning equipment may become dissatisfied, which can result in decreased library visits and reduced engagement with digital programs. Furthermore, insufficient digital literacy support often due to overstretched or under trained library staff, intensifies these frustrations and limits user's ability to utilize available services effectively.

Effective digital literacy programs and responsive service practices are also integral to enhancing user satisfaction. Rural public libraries that invest in staff training and structured digital learning sessions generally demonstrate higher levels of user engagement and satisfaction (PSLC,2023). Conversely, when library staff lack the skills or confidence to guide patrons, users may struggle to navigate digital platforms, leading to dissatisfaction and under-utilization. Incorporating structured mechanisms can help libraries identify specific user concerns and adjust services accordingly. Evidence from Malaysian library studies shows that libraries that actively collect and act on user feedback tend to improve community trust and service relevance (Hassan & Ismail, 2023). Strengthening digital literacy support, improving communication with users and ensuring reliable technology can significantly enhance satisfaction levels and reinforce the sustainability of digital service in rural public libraries.

1.4 Purpose of Study

The purpose of this study is to assess the current state of digital technology sustainability in rural public libraries in Pahang, with a focus on understanding librarian perspectives and user satisfaction. Specifically, the study aims to investigate the availability, awareness, and usage of digital technologies in these libraries, as well as their impact on user satisfaction and long-term sustainability. By examining these factors, the study seeks to identify gaps and challenges in the adoption of digital technologies and provide actionable recommendations to enhance the effectiveness and relevance of rural public libraries in the digital era. Ultimately, this research aims to contribute to the development of sustainable digital strategies that improve access to information, foster digital literacy, and ensure the continued viability of rural libraries in Pahang and beyond.

1.5 Research Objectives

- RO1 : To investigate the current state of digital technology availability and awareness in rural public libraries in Pahang
- RO2 : To examine the perspectives of librarians on the challenges and opportunities in sustaining digital technology in rural public libraries
- RO3 : To analyze the mediating effect of user satisfaction between awareness, usage, and the sustainability of digital services in rural public libraries

1.6 Research Questions

- RQ1 : What is the current state of digital technology availability and awareness in rural public libraries in Pahang?
- RQ2 : How do librarians in rural public libraries perceive the challenges and opportunities in sustaining digital technology services?
- RQ3 : How does user satisfaction mediate the relationship between the use of digital technology and the sustainability of digital services in rural public libraries?

1.7 Operational Definitions

There are several definitions of commonly used terms in this study that require definition. These terms are also the keywords of this study.

1.7.1 Rural Public Library

A rural public library refers to a community-based library located in non-urban areas, typically serving smaller populations with limited access to educational and informational resources. These libraries provide free access to books, digital resources, and other services to support literacy, education, and community development (Abdullah, N., & Kassim, N. A. 2019; Abu. R Abu, SK Rafie, MH Mansor. 2024). In the context of this study, rural public libraries specifically refer to those operating in Pahang, Malaysia, which face unique challenges such as limited funding, inadequate infrastructure, and lower digital technology adoption compared to urban libraries (IFLA, 2018).

1.7.2 Digital Technology

Digital technology refers to electronic tools, systems, and resources that facilitate access to, storage, and dissemination of information. In the context of libraries, this includes computers, internet access, digital catalogs, e-books, online databases, and other digital platforms that enhance library services (Singh, R., & Mulla, Z., 2021; NA Azib, R Abu, SK Rafie, N Syfaâ, M Tokiran, 2024). For this study, digital technology encompasses both the hardware and software used in rural public libraries to support user needs and improve service delivery.

1.7.3 Sustainability

Sustainability in the context of digital technology refers to the ability of rural public libraries to maintain and enhance their digital services over the long term. This includes ensuring the availability of digital infrastructure, continuous funding, user training, and the adaptability of technologies to meet evolving user needs. For this study, sustainability is measured by the effectiveness of digital technologies in meeting

user demands, the level of user satisfaction, and the libraries' capacity to sustain these technologies despite resource constraints (UN, 2015; Chowdhury, G., 2019).

1.7.4 Librarian and Information Professional

A librarian or information professional in this study refers to individuals employed by rural public libraries who are responsible for managing library resources, providing user services, and facilitating access to digital technologies. These professionals play a critical role in promoting digital literacy, training users, and ensuring the effective use of digital resources. Their perspectives are essential for understanding the challenges and opportunities related to digital technology sustainability in rural libraries (MLM, 2020; Rubin, R. E., 2016).

1.7.5 Library Users

Library users in this study refer to individuals who access and utilize the services and resources provided by rural public libraries, including digital technologies. These users may include students, researchers, professionals, and community members seeking information, education, or leisure activities. User satisfaction is a key metric in this study, reflecting their experiences and perceptions of the digital services offered by the library (Islam, M. S., & Ahmed, S. Z., 2020; R Abu, SK Rafie, H Sha'ari; 2023).

1.8 Scope Of Study

This research focuses on assessing the sustainability of digital technology in rural public libraries (RPLs) in Pahang, Malaysia, with emphasis on three key dimensions: technology awareness, usage patterns and service quality. This study examines how these dimensions influence user satisfaction and contributes to the long-term sustainability of digital services. To achieve this, the research adopts a mixed methods design consisting of qualitative interviews with rural librarians and quantitative surveys involving 2,660 library users. This approach enables a comprehensive understanding of user experiences, librarian perspectives and the challenges that shape digital technology sustainability within rural library environments.

The scope of this study is intentionally centered on Pahang due its significant representation of rural libraries within peninsular Malaysia. According to the Pahang State Library Corporation (PSLC, 2023), Pahang has one of the highest numbers of rural public libraries in the region, serving geographically dispersed and socioeconomically diverse communities. This makes Pahang an ideal context of examining the sustainability of digital initiatives, especially given the state's varying levels of digital infrastructure, broadband coverage and community digital challenges that reflect broader national issues while still allowing for context specific analysis.

Furthermore, the research considers the unique factors influencing digital technology sustainability in Pahang's rural communities, including funding constraints, infrastructural limitations and disparities in digital literacy. These contextual elements directly affect how digital services are implemented, used and maintained across different library branches. By grounding the investigation within this localized setting, the findings are positioned to offer practical insights for policymakers, librarians and government agencies seeking to strengthen digital services in rural Malaysia. Ultimately, the study aims to contribute to antional efforts to reduce digital disparities and support the long-term viability of digital technology in rural public libraries.

1.9 Significance Of Study

This study holds significant value for multiple stakeholders, including policymakers, library administrators, librarians, users, and researchers, by addressing critical issues related to digital technology sustainability in rural public libraries. The significance of this research can be categorized into three main areas: 1) theoretical contributions, 2) practical implications, and 3) societal impact.

1.9.1 Theoretical Contributions

This study contributes to the growing body of knowledge on digital technology adoption and sustainability in rural public libraries, particularly in the context of developing countries like Malaysia. By integrating concepts such as digital literacy, user satisfaction, and technology sustainability, the research provides a comprehensive framework for understanding the interplay between these factors. The findings will

enrich existing literature and offer new insights into how rural libraries can effectively leverage digital technologies to meet the needs of their communities.

1.9.2 Practical Implications

For library administrators and policymakers, this study provides actionable recommendations to improve the availability, awareness, and usage of digital technologies in rural public libraries. By identifying the gaps and challenges faced by libraries in Pahang, the research offers practical strategies to enhance digital infrastructure, provide training for librarians and users, and ensure the long-term sustainability of digital services. These insights can guide the allocation of resources and the development of policies that support the digital transformation of rural libraries.

1.9.3 Societal Impacts

Rural public libraries play a crucial role in bridging the digital divide and promoting equitable access to information and education. This study highlights the importance of digital technology sustainability in empowering rural communities, fostering digital literacy, and supporting lifelong learning. By improving the effectiveness of rural libraries, the research contributes to the broader goals of social inclusion, community development, and sustainable growth in underserved areas. Additionally, the study emphasizes the role of user satisfaction in ensuring that digital services meet the needs and expectations of library users, thereby enhancing their overall experience and engagement.

1.10 Summary Of Chapter

This chapter introduced the research study titled "Assessing the State of Pahang Librarian Perspectives and User Satisfaction on Digital Technology Sustainability in the Rural Public Library." The study is motivated by the growing importance of digital technology in enhancing the role of public libraries, particularly in rural areas where access to information and digital resources is often limited. The background of the study highlighted the challenges faced by rural public libraries in Pahang, Malaysia, including inadequate digital infrastructure, low technology awareness, and limited user

engagement with digital services. These challenges underscore the need to investigate the sustainability of digital technologies in rural libraries and their impact on user satisfaction.

The problem statement emphasized the gap in understanding how digital technology adoption and sustainability influence user satisfaction and the long-term viability of rural public libraries. To address this gap, the study proposed three research objectives: (1) to investigate the current state of digital technology availability and its impact on user satisfaction, (2) to examine the influence of technology awareness and usage on digital technology sustainability, and (3) to explore the mediating role of user satisfaction in achieving digital technology sustainability. Corresponding research questions were formulated to guide the investigation.

The significance of the study lies in its potential to contribute to both theoretical and practical knowledge. Theoretically, it enriches the literature on digital technology sustainability in rural libraries, particularly in the context of developing countries like Malaysia. Practically, it provides actionable recommendations for policymakers, library administrators, and librarians to enhance digital services and ensure their long-term sustainability. Socially, the study aims to bridge the digital divide in rural communities by improving access to digital resources and fostering digital literacy.

Finally, the scope of the study was defined to focus on rural public libraries in Pahang, Malaysia, considering the unique socioeconomic and technological challenges of the region. By employing a mixed-methods approach, the study seeks to gather comprehensive data from both library users and librarians, ensuring a holistic understanding of the issues at hand. In the following chapters, the study will delve into the literature review, research methodology, data analysis, and discussion of findings, ultimately providing insights that can inform the future development of rural public libraries in the digital age.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter presents a comprehensive review of literature related to digital technology sustainability in rural public libraries, with a specific focus on the roles of librarians and user satisfaction. The review is structured to explore the fundamental principles and concepts underpinning the study, including the role of librarians, user satisfaction, digital technology, and sustainability. It also examines the library digital technology sustainability plan in Malaysia and reviews relevant theories and models from both qualitative and quantitative research traditions. Finally, the chapter develops a conceptual framework and formulates hypotheses to guide the study.

The literature review is organized into seven main sections. Section 2.2 discusses the basic principles and concepts of the study, including the role of librarians, user satisfaction, digital technology, and its sustainability. Section 2.3 focuses on the library's digital technology sustainability plan in Malaysia, providing context-specific insights. Sections 2.4 and 2.5 review previous theories and models from qualitative and quantitative research, respectively, such as thematic analysis, the Delone and Mclean IS success model Information and Use of Technology, diffusion of innovation, the Three Pillars of Sustainability Framework, and the IASAM model. Section 2.6 develops the conceptual framework for the study, integrating key concepts such as digital literacy, collaboration, community engagement, technology awareness and usage, user satisfaction, and rural public library (RPL) digital technology sustainability. This section also formulates the study's hypotheses, which explore the relationships between technology awareness, usage, user satisfaction, and digital sustainability. Finally, Section 2.7 provides a summary of the chapter, synthesizing the key insights and their relevance to the study.

By systematically reviewing the literature, this chapter establishes a strong theoretical foundation for the research, identifies gaps in existing knowledge, and provides a framework for understanding the interplay between librarian perspectives, user satisfaction, and digital technology sustainability in rural public libraries. The insights gained from this review will inform the research design, methodology, and

analysis, ultimately contributing to the study's goal of enhancing the effectiveness and relevance of rural public libraries in the digital era.

2.2 Basic Principle and Concept of the Study

This section will explain the foundational concepts of the role of librarians, user satisfaction, digital technology, and sustainability, that are in line with this study.

2.2.1 Librarian Role

In the real world, Librarian's responsibilities include hiring employees, ordering books from publishers, processing late fees if necessary, and organizing book displays. Librarians also coordinate community programs that increase library awareness while evaluating inventory needs for new technologies within their local system. Nonetheless, the role of librarians has evolved significantly in the digital age. The latest generation of librarians are required to familiarize themselves with digital, electronic, and other online resources. In this new age of assembling and disseminating information, there is need for special libraries and librarians to manage these technologies and provide different digital, electronic information services to the users. particularly in rural public libraries, where they serve as critical facilitators of information access, digital literacy, and community engagement.

Traditionally, librarians were primarily responsible for managing physical collections and providing reference services. However, with the advent of digital technologies, their role has expanded to include managing digital resources, promoting digital literacy, and ensuring the effective use of technology to meet user needs (Abdullah & Kassim, 2019). In the context of rural public libraries, librarians play an even more pivotal role due to the unique challenges these libraries face, such as limited resources, lower technology adoption rates, and the need to bridge the digital divide.

Hence, the digital transformation of libraries has necessitated a shift in the role of librarians from custodians of books to facilitators of digital knowledge. In rural public libraries, this transformation is even more critical, as librarians are often the primary drivers of digital inclusion and community development. By embracing their evolving roles, librarians can help bridge the digital divide, empower rural communities, and ensure the sustainability of digital services (Chowdhury, 2019).

2.2.2 Library User Satisfaction

User satisfaction is a critical measure of the effectiveness and success of library services, particularly in the context of rural public libraries where resources are often limited, and user needs are diverse. It reflects the extent to which library users perceive that their expectations and needs are being met by the services and resources provided. In the digital age, user satisfaction is increasingly tied to the availability, accessibility, and usability of digital technologies, as well as the quality of support provided by librarians (Hernon & Altman, 2010). For rural public libraries, ensuring high levels of user satisfaction is essential for fostering community engagement, promoting digital literacy, and sustaining the long-term viability of library services.

Many studies have found that, user satisfaction is heavily influenced by the availability of digital resources such as e-books, online databases, and internet access. In rural libraries, where physical collections may be limited, digital resources play a crucial role in meeting user needs (Islam & Ahmed, 2020). The usability of digital technologies, including user-friendly interfaces and reliable internet connectivity, is a significant factor in user satisfaction. Rural libraries must ensure that digital services are accessible to all users, including those with limited technical skills (Singh & Mulla, 2021). Meanwhile, the quality of library support services also plays an important role in cultivating users satisfaction. The assistance provided by librarians, such as training on digital tools and personalized support, directly impacts user satisfaction. Librarians in rural libraries often serve as the primary point of contact for users seeking help with digital resources (Rubin, 2016).

User satisfaction is not only a measure of service quality but also a key driver of library sustainability. Satisfied users are more likely to utilize library services regularly, advocate for library funding, and participate in community programs. In rural public libraries, where funding and resources are often scarce, high levels of user satisfaction can help demonstrate the value of libraries to stakeholders and secure ongoing support (IFLA, 2018). Furthermore, user feedback can provide valuable insights for improving digital services and ensuring they remain relevant to community needs (Chowdhury, 2019).

2.2.2.1 Rural Public Library

Rural public libraries (RPLs) in Malaysia play an essential role in bridging the digital divide by providing access to information and technology resources to underserved communities. According to a report by the Ministry of Education Malaysia (2022), rural libraries are pivotal in supporting literacy, lifelong learning, and information access in regions where connectivity and digital infrastructure are limited. In rural areas, public libraries often serve as the sole source of internet access and digital tools, highlighting their importance in promoting digital inclusion and social development. However, despite these efforts, challenges remain in ensuring that rural public libraries are equipped to meet the growing technological needs of their communities.

One of the key challenges faced by Malaysian rural libraries is the lack of infrastructure and resources to sustain digital technology. Studies such as those by Hashim and Ismail (2023) show that rural public libraries in Malaysia often struggle with outdated technology, insufficient funding, and limited technical staff, which hinders their ability to provide high-quality digital services. These limitations directly impact user satisfaction, as library patrons in rural areas may experience difficulties accessing online resources, e-books, and digital databases, reducing the overall effectiveness of these services. Furthermore, the lack of continuous training for library staff on emerging technologies exacerbates these issues, leading to a disparity in service quality compared to urban libraries.

In response to these challenges, the Malaysian government has implemented various initiatives to enhance digital technology in rural public libraries. Programs such as the Perpustakaan Desa (Rural Libraries) initiative aim to improve infrastructure, provide digital literacy training, and expand the availability of digital resources in rural libraries (National Library of Malaysia, 2021). These initiatives have seen moderate success, with some rural libraries showing significant improvements in their digital services. However, there remains a need for more consistent and sustainable efforts to ensure long-term digital technology sustainability. Studies indicate that while some libraries have successfully adopted new technologies, the overall sustainability of digital services in rural Malaysia remains fragile (Rahman & Lim, 2022).

In State of Pahang, for example, there is a total number of 62 rural public library (29 rural libraries State, 33 rural libraries NLM). The digital technology efforts in rural libraries in Pahang, Malaysia, are part of a broader initiative to modernize library services and bridge the digital divide between urban and rural areas. The Pahang State Library Corporation (PSLC) and the National Library of Malaysia have been working to integrate digital technologies into rural libraries to enhance access to information and improve literacy rates. Rural libraries in Pahang are increasingly being equipped with computers and internet access to provide users with digital resources, including e-books, online databases, and educational platforms. The National Library of Malaysia's ePustaka platform is often promoted in rural libraries, offering access to a wide range of digital materials. However, progress has been gradual due to challenges such as limited infrastructure, funding constraints, and low digital literacy among rural populations.

The role of rural public libraries extends beyond providing access to information; they also act as community hubs that foster social inclusion and community development. As noted by Aziz and Jalaluddin (2023), rural libraries in Malaysia offer crucial support for local education systems and act as safe spaces where community members can engage in learning activities. In this context, digital technology not only serves as a tool for information retrieval but also as a means of empowering communities to participate in the digital economy. By offering access to digital services, rural libraries play a key role in enhancing digital literacy among rural populations, thereby helping to close the digital divide and contribute to rural socioeconomic development.

However, despite their potential, the sustainability of digital services in Malaysia's rural public libraries remains uncertain. As user demands for more advanced digital services increase, many rural libraries face difficulties in maintaining these services due to inconsistent funding and resource allocation (Horrigan, 2023). The literature highlights the need for a comprehensive strategy that addresses the long-term sustainability of digital technology in rural libraries by focusing not only on technology acquisition but also on maintaining infrastructure, staff training, and user support. Without such efforts, rural public libraries risk falling behind in their ability to meet the digital needs of their communities, thereby limiting their role in rural development.

In summary, rural public libraries in Malaysia are critical institutions for promoting digital inclusion and supporting community development in underserved areas. While various government initiatives have been launched to enhance digital technology in these libraries, significant challenges remain in sustaining these efforts. The literature highlights that factors such as limited infrastructure, inadequate staff training, and inconsistent funding continue to hinder the ability of rural libraries to provide satisfactory digital services. Therefore, this study seeks to address these challenges by evaluating user satisfaction with digital technology sustainability in rural public libraries, offering insights that could help improve the long-term viability of these essential services.

2.2.3 Digital Technology

Digital technology has become a critical tool for transforming rural libraries, particularly in regions like Pahang, Malaysia, where efforts are being made to bridge the digital divide and enhance access to information. However, challenges such as limited infrastructure, inconsistent internet connectivity, and low digital literacy among rural populations persist.

Technology awareness and usage remain key barriers to the effective implementation of digital library services. While digital literacy programs have been introduced to educate rural communities, there is a need for more comprehensive outreach and training to ensure widespread adoption. Collaboration between government agencies, NGOs, and private sector partners has been crucial in addressing these challenges, but sustained efforts are required to achieve equitable access to digital resources.

2.2.3.1 *Technology Awareness and Usage*

The success of digital technology initiatives in rural libraries depends heavily on the awareness and usage of these tools by the target population. In Pahang, efforts to promote technology awareness have included digital literacy workshops, community outreach programs, and partnerships with local schools and organizations. These initiatives aim to equip rural residents with the skills needed to navigate digital platforms and access online resources effectively.

However, many studies indicate that technology usage in rural areas remains low due to factors such as limited exposure to digital tools, lack of confidence in using technology, and insufficient training opportunities. For instance, a 2022 study published in the *Malaysian Journal of Library & Information Science* found that while rural libraries in Pahang have made strides in providing digital access, the uptake of these services is hindered by low awareness and engagement among community members.

By focusing on both technology adoption and awareness, rural libraries in Pahang can maximize the impact of digital initiatives and ensure that all community members benefit from these advancements.

2.2.4 Sustainability

Sustainability has emerged as a critical concept in both environmental and technological sectors, emphasizing the need for practices that meet current needs without compromising the ability of future generations to meet their own. In the digital realm, sustainability involves not only maintaining technological infrastructures but also ensuring their long-term efficiency, accessibility, and environmental responsibility (Hassan & Ismail, 2023). Sustainable development integrates economic, social, and environmental goals, with increasing attention to green technology and energy-efficient systems as key components (Lim & Wahab, 2023). This approach is particularly relevant in rural contexts, where limited resources and outdated technology present significant barriers to achieving sustainability (Yusof & Rahman, 2022). As digital technology becomes integral to development strategies worldwide, ensuring its sustainability is crucial for addressing the challenges of digital inclusion, environmental impact, and social equity.

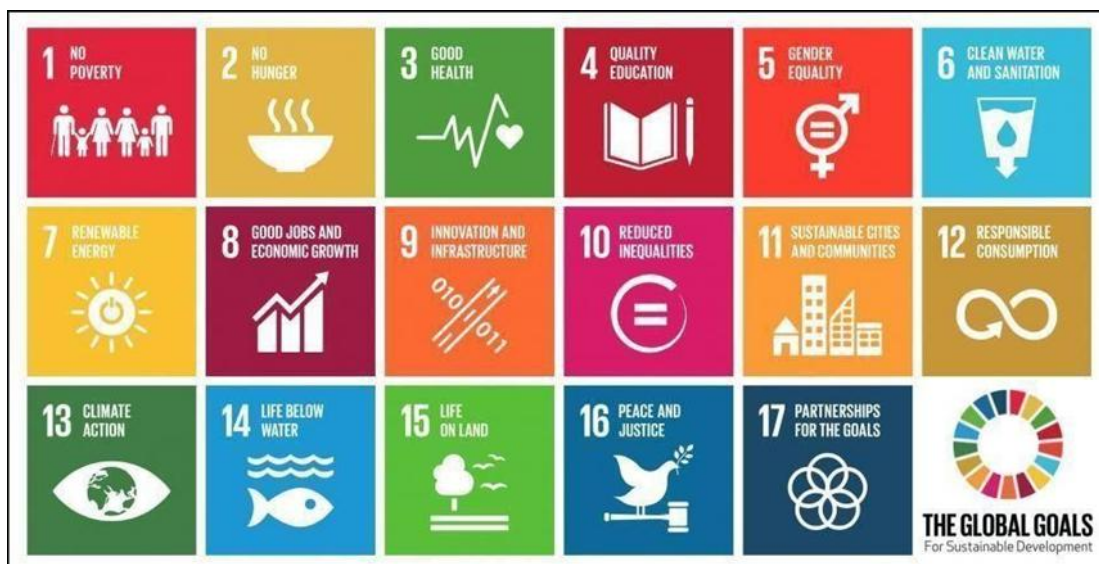


Figure 2.1 The Sustainable Development Goals (United Nations)

The United Nations' 17 Sustainable Development Goals (SDGs) serve as a comprehensive blueprint for global efforts addressing inequality, education, and sustainability. With libraries acting as critical community institutions, these goals offer a lens through which the role of rural public libraries can be understood in terms of digital inclusion, knowledge access, and educational opportunity. Recent research in Malaysia, such as *Digital Advancements in Rural Public Libraries* (Mansor, Abu & Rafie, 2025), underscores how limitations in infrastructure, awareness, and service quality hinder user satisfaction and pose challenges for sustainable digital initiatives.

Among the SDGs, SDG 4 (Quality Education), SDG 9 (Industry, Innovation and Infrastructure), and SDG 10 (Reduced Inequalities) are particularly salient for rural public libraries. These goals emphasize equitable access to digital tools, robust infrastructure, and reducing gaps between rural and urban users. For example, *Electronic Resources in Academic Libraries and Its Contribution Towards Sustainable Development Goals* (Haliza et al., 2023) show how providing e-resources can help fulfill these goals by enhancing access to education and reducing educational disparities.

Moreover, SDG 17 (Partnerships for the Goals) highlights the need for collaboration and stakeholder engagement to sustain SDG progress. Library institutions can play a stronger role by aligning government bodies, academic partners, and local communities. The IFLA's "Libraries partnering for the SDGs" report (2023) points to successful cases where libraries expand their impact through partnerships.

IFLA Similarly, Barbara Lison's (2024) study Libraries, Community Empowerment, and the UN SDGs argue that libraries have begun transforming themselves into active agents of change, aligning services, programs, and outreach with the SDG framework.

2.2.5 Digital Technology Sustainability

Digital technology sustainability refers to the ability to maintain and improve digital infrastructures, ensuring they remain accessible, efficient, and eco-friendly over time. In rural public libraries, this concept is particularly important because these libraries are often the primary source of digital access for rural communities (Yusof & Rahman, 2022). As technology evolves, maintaining sustainability involves continuous upgrading of digital systems, ensuring energy efficiency, and promoting user engagement. Digital sustainability also encompasses the long-term financial viability of digital technologies, which is often a challenge for libraries with limited budgets (Hassan & Ismail, 2023). In Malaysia, the government's commitment to sustainable development is reflected in its digital inclusion policies, which aim to bridge the digital divide in rural areas through sustainable technology solutions.

A crucial aspect of digital technology sustainability is environmental sustainability. Green ICT initiatives, which aim to reduce the environmental impact of digital technologies, are becoming increasingly relevant in the context of rural public libraries. These initiatives focus on using energy-efficient hardware, reducing electronic waste, and implementing renewable energy sources like solar power for digital infrastructures (Lim & Wahab, 2023). Studies show that incorporating sustainable technology practices can significantly reduce operational costs and extend the life cycle of digital devices, making it a practical approach for libraries with limited resources. Libraries adopting green ICT practices also align with Malaysia's broader commitment to the United Nations Sustainable Development Goals (SDGs), particularly Goal 12 (Responsible Consumption and Production) and Goal 13 (Climate Action).

Another critical component of digital technology sustainability is the socioeconomic impact of digital services on rural communities. The provision of digital resources in rural public libraries supports education, job creation, and overall community development (Hassan, 2023). However, sustaining these services requires

ongoing support from both government and non- governmental organizations, as well as community participation. Digital literacy training programs are essential for ensuring that rural populations can fully utilize and benefit from digital technologies. According to Rahman and Ismail (2022), engaging local communities in the planning and implementation of digital services ensures that these technologies meet user needs and fosters a sense of ownership, which is crucial for long-term sustainability.

Despite the progress in policy and infrastructure, challenges remain in achieving fully sustainable digital ecosystems in rural Malaysia. Studies highlight issues such as inconsistent funding, lack of skilled staff, and difficulties in maintaining digital technologies in the long term (Hassan & Ismail, 2023). Addressing these challenges requires not only technological advancements but also community engagement and capacity-building efforts. The sustainability of digital technology in rural public libraries will largely depend on how well these libraries can adapt to evolving digital demands while maintaining service quality and resource management. By focusing on sustainable practices, Malaysia can ensure that rural libraries continue to play a central role in bridging the digital divide and supporting rural development.

The adoption of new digital technologies is only one aspect of technological growth in rural public libraries. Maintaining and improving digital resources over time, despite budgetary limitations, outdated infrastructure, and other financial obstacles, is essential to real growth. Inadequate high-speed internet and a lack of qualified staff are further difficulties, since maintaining and assisting digital resources calls for specific training that rural libraries frequently find difficult to offer.

In conclusion, the sustainability of digital technology in rural public libraries is a multi-faceted issue that involves technological, environmental, and social considerations. While green ICT and renewable energy solutions can address environmental concerns, sustaining digital technology services requires continuous community engagement, financial support, and capacity building. Malaysia's commitment to sustainable development, particularly through its digital inclusion policies, provides a framework for addressing these challenges. However, ensuring that rural public libraries can maintain and improve their digital services in a sustainable manner will require ongoing collaboration between government bodies, libraries, and rural communities. The success of these efforts will ultimately contribute to bridging the digital divide and fostering socioeconomic development in rural Malaysia.

2.3 Library Digital Technology Sustainability Plan in Malaysia

Digital technology sustainability in libraries is a critical issue, particularly in Malaysia, where the transition to a knowledge-based society is a national priority. Libraries are no longer just repositories of printed materials but have evolved into hybrid spaces that integrate digital services, artificial intelligence (AI), and data analysis. The sustainability of these digital transformations depends on factors such as funding, policy frameworks, infrastructure, and digital literacy among library staff and users.

In Malaysia, several initiatives are underway to improve library technology's ecological sustainability and longevity. The UTM Library's "enVision 2025" Planned Plan is a prime example. It shows how the library will change to the university community's evolving needs via several sustainable digital strategies. This plan stresses open research, using the Open Science Initiative and the UTM Virtual Gallery to share institutional knowledge and an important portion of its heritage. The National Library of Malaysia is modernizing by using artificial intelligence (AI) and robotics to stay up to date. The library's five-year plan for 2024-2028 integrates a facial recognition technology system for monitoring visitors and staff and several chat-bots to assist visitors with accessing services.

M. H. explore the opportunities and challenges of digital technology for Malaysian rural public libraries in their 2024 article, "Digitizing Sustainability: Exploring the Opportunities and Challenges for Rural Public Libraries Adopting Technology." This article explores how digital technologies can improve information access as well as community engagement in rural areas, while dealing with problems such as the digital divide along with limited funding.

The National Library of Malaysia's 2022 report, *Digital Transformation in Malaysian Libraries: Challenges and Opportunities*, offers a comprehensive analysis of the current state of digital transformation in Malaysian libraries. It highlights the progress achieved as well as the persistent challenges. The report emphasizes the critical role of digital technologies in enhancing library services, improving accessibility, and addressing the evolving needs of users in an increasingly digital world.

Malaysian libraries have made significant strides in adopting digital technologies, including the development of digital catalogs, e-resources, and online access platforms. Initiatives such as the National Library's digital repository and

collaborative efforts with academic and public libraries have further expanded access to digital content. Additionally, the Malaysian government has shown strong support by increasing funding and policy measures to accelerate this digital transformation. Public-private partnerships, including collaborations with tech companies and international organizations, have also been initiated to provide innovative solutions and secure funding.

To build capacity, various training programs have been organized for librarians and users to enhance digital literacy and ensure the effective utilization of digital resources. Furthermore, open access initiatives have been promoted to expand access to educational and research materials, democratizing knowledge and improving accessibility for all. The report emphasizes that while Malaysian libraries have made commendable progress in their digital transformation journey, sustained efforts are needed to address existing challenges and seize emerging opportunities. By adopting a strategic, collaborative, and inclusive approach, Malaysian libraries can ensure long-term sustainability and continue to play a vital role in the nation's knowledge economy. These resources provide valuable insights into the current strategies and considerations for implementing sustainable digital technologies in Malaysian libraries.

2.4 Previous Theories and Model: Qualitative Research

Qualitative research provides an essential foundation for understanding the complex factors that influence digital technology adoption and sustainability in rural public libraries (RPLs). While quantitative methods capture measurable constructs such as awareness, usage and satisfaction, qualitative inquiry uncovers deeper insights into the lived experiences, operational challenges and contextual realities faced by librarians and rural communities. This depth is especially important in the Pahang context, where disparities in digital literacy, infrastructure readiness and community engagement shape the effectiveness of digital initiatives. Qualitative findings help explain why certain technologies are underutilized, why sustainability remains difficult to achieve and how librarian perceptions influence the overall success of digital services, dimensions that cannot be captured fully through statistical data alone.

In this study, qualitative methods, particularly thematic analysis, are used to explore patterns in librarian experiences related to digital literacy support, community partnership and day-to-day management of digital technologies. These insights directly

inform the development of the quantitative instrument and strengthen the research framework by ensuring that the constructs being measured reflect real operational challenges rather than theoretical assumptions. By grounding the research in qualitative evidence, the study develops a more holistic understanding of digital technology sustainability in rural libraries, ensuring that subsequent quantitative analysis remains contextually and aligned with the realities of rural public library environments in Malaysia.

2.4.1 Thematic Analysis

Thematic analysis is a widely used qualitative research method that involves identifying, analyzing, and reporting patterns (themes) within data. It is particularly useful for exploring complex phenomena, such as the adoption and sustainability of digital technologies in rural public libraries. Thematic analysis allows researchers to uncover underlying themes that reflect the experiences and perspectives of librarians and users, providing a rich understanding of the factors that influence digital technology sustainability (Braun & Clarke, 2006). Table below shoes all the steps taken in this study thematic analysis:

Table 2.1
Steps Taken for Thematic Analysis

Steps	Thematic Analysis Process Detail
Familiarization with Data	Researchers immerse themselves in the data, which may include interview transcripts, focus group discussions, or observational notes, to gain a deep understanding of the content.
Generating Initial Codes	Data is systematically coded to identify meaningful segments related to the research questions.
Searching for Themes	Codes are grouped into broader themes that capture recurring patterns or ideas. Themes are refined to ensure they accurately represent the data.
Reviewing Themes	Themes are reviewed and validated against the data to ensure they are coherent, distinct, and relevant to the research objectives.
Defining and Naming Themes	Each theme is clearly defined and named to reflect its essence.
Producing the Report	The findings are presented in a narrative format, supported by illustrative quotes and examples from the data.

Thematic analysis provides a systematic and flexible approach to understanding the complex dynamics of digital technology sustainability in rural public libraries (RPLs). By following the steps of thematic analysis—familiarization with data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the report—researchers can uncover meaningful patterns and insights that reflect the experiences and perspectives of librarians and users. This method is particularly well-suited for exploring the interplay between digital literacy, partnerships, and community engagement, which are central to the sustainability of digital technologies in RPLs. In the context of this study, thematic analysis will be instrumental in identifying the challenges and opportunities faced by rural libraries in Pahang, Malaysia, as they strive to adopt and sustain digital technologies. By applying thematic analysis, this research aims to provide actionable insights that can enhance the effectiveness of digital services, improve user satisfaction, and ensure the long-term sustainability of rural public libraries in the digital era.

2.4.1.1 RPL Technology Works (Digital Literacy, Partnership, Community Engagement)

Thematic analysis has been effectively used to explore how digital technologies are implemented and sustained in rural public libraries, with a focus on three key areas: digital literacy, partnerships, and community engagement. These themes are critical for understanding the role of RPLs in bridging the digital divide and fostering sustainable development in rural communities. A recent study by Abu, Rafie, and Mansor (2024) provides valuable insights into the opportunities and challenges of adopting digital technologies in RPLs, particularly in the context of Malaysia.

a) Digital Literacy

Digital literacy is a cornerstone of digital technology sustainability in RPLs. Thematic analysis has revealed that rural libraries play a crucial role in promoting digital literacy among users, particularly in communities with limited access to technology. Key findings include:

Table 2.2
Digital Literacy Key Findings

Challenges in Digital Literacy	Impact of Digital Literacy Programs
Many rural library users lack basic digital skills, such as using computers, navigating the internet, or accessing online resources. Librarians often take on the role of educators, providing training and support to bridge this gap (Abu et al., 2024)	Libraries that offer digital literacy programs, such as workshops on using e-books or online databases, report higher levels of user engagement and satisfaction. Abu et al. (2024) highlight the importance of tailored programs that address the specific needs of rural communities.

b) Partnerships

Partnerships are essential for enhancing the sustainability of digital technologies in RPLs. Thematic analysis has highlighted the importance of collaborations with government agencies, non-profits, and private organizations. Key findings include:

Table 2.3
Partnerships Key Findings

Funding And Resource Sharing	Impact of Digital Literacy Programs
Partnerships enable rural libraries to Access funding, technology, and expertise that would otherwise be unavailable. For example, collaborations with tech companies can provide libraries with discounted or donated hardware and software (Abu et al., 2024).	Partnerships with educational institutions and NGOs can support capacity-building initiatives, such as training librarians in digital resource management. Abu et al. (2024) emphasize the role of partnerships in overcoming resource constraints in rural libraries.

c) Community Engagement

Community engagement is a critical factor in ensuring the relevance and sustainability of digital technologies in RPLs. Thematic analysis has shown that libraries that actively engage with their communities are more successful in implementing and sustaining digital services. Key findings include:

Table 2.4
Community Engagement Key Findings

Tailoring Services to Community Needs	Building Trust and Ownership
Libraries that involve community members in decision-making processes are better able to tailor their digital services to meet local needs.	Community engagement fosters a sense of ownership and trust, encouraging users to actively participate in library programs and advocate for

For example, libraries in agricultural communities might provide access to online farming resources (Abu et al., 2024).	library funding. Abu et al. (2024) highlight the importance of community-driven initiatives in ensuring the long-term sustainability of digital technologies.
--	--

The application of thematic analysis to RPL technology works—specifically focusing on digital literacy, partnerships, and community engagement— provides a robust framework for addressing the core objectives of this study. By systematically analyzing qualitative data from librarians and users in rural public libraries in Pahang, Malaysia, thematic analysis will help uncover the underlying factors that influence the adoption and sustainability of digital technologies. For instance, identifying themes related to digital literacy challenges will shed light on the specific training needs of users and librarians, enabling the development of targeted programs to bridge the digital divide. Similarly, exploring themes around partnerships will reveal opportunities for collaboration with government agencies, NGOs, and private organizations to secure funding, resources, and expertise. Finally, analyzing themes related to community engagement will highlight strategies for tailoring digital services to meet local needs and foster a sense of ownership among users. These insights will directly support the study’s objectives by providing actionable recommendations to enhance digital technology sustainability, improve user satisfaction, and ensure the long-term viability of rural public libraries in Pahang. Thus, thematic analysis serves as a critical tool for achieving the study’s goals and contributing to the broader discourse on digital inclusion and library sustainability.

2.5 Previous Theories and Model: Quantitative Research

Quantitative research provides a systematic and statistical foundation for examining the relationships between key variables that influence the sustainability of digital technologies in rural public libraries (RPLs). While qualitative insights offer contextual understanding, quantitative analysis enables this study to test the strength and direction of factors such as technology awareness, usage patterns, service quality and user satisfaction. This approach is essential for evaluating sustainability in RPLs because it allows for empirical measurement and comparison across a large population of users, generating generalize findings that can inform policy and practice. In the

context of Pahang, where rural libraries exhibit diverse levels of digital readiness. Quantitative models help to identify which factors significantly predict sustainable digital service outcomes and how these relationships differ across communities.

This study draws upon several established theories in library and information science research to guide the quantitative phase including the DeLone and Mclean Information Systems (IS) Success Model, the Diffusion of Innovation (DOI) theory, the Three Pillars of Sustainability Framework and the IASAM Model. These models collectively provide a robust theoretical basis for understanding how information quality, system functionality, user engagement and organizational factors contribute to long term digital sustainability. For example, the IS Success Model emphasizes user satisfaction as a key determinant of continued system of use while DOI theory highlights the role of awareness and adoption patterns in technology diffusion. Similarly, sustainability frameworks emphasize the balance between technological maintenance, resource allocation and user outcomes. By integrating these models, the study identifies measurable pathways through which awareness, usage and satisfaction influence sustainability, enabling a deeper understanding of how digital services can be strengthened in rural public libraries.

2.5.1 The DeLone and McLean Information Systems (IS) Success Model

The DeLone and McLean Information Systems (IS) Success Model, first introduced in 1992 and later updated in 2003, provides a comprehensive framework for assessing the effectiveness of information systems across various contexts. The model identifies six key dimensions that contribute to IS success: System Quality, Information Quality, Service Quality, Use, User Satisfaction, and Net Benefits (DeLone & McLean, 2003). These components are interconnected in a causal chain, where the quality dimensions influence both the level of system use and the satisfaction of its users, which in turn determine the overall benefits derived from the system. This model has become one of the most widely cited frameworks in the field of information systems due to its flexibility and applicability across different sectors, including public service institutions like libraries. It emphasizes the importance of evaluating not just technological features, but also the user experience and the actual impact of technology on organizational goals.

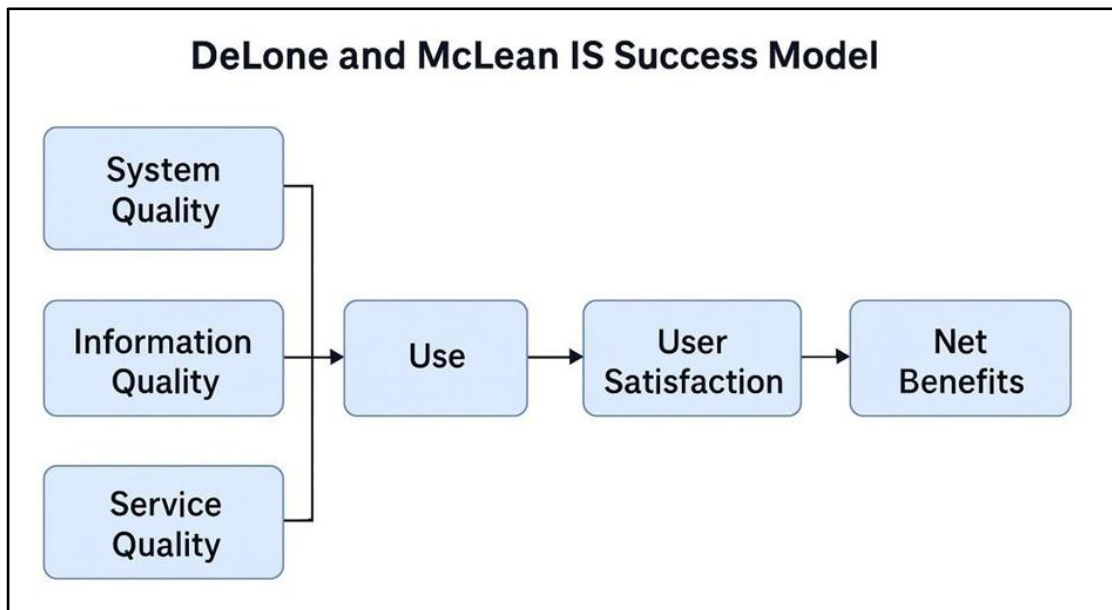


Figure 2.2 DeLone and Mclean IS Success Model

In the context of rural public libraries, particularly within the framework of evaluating digital technology sustainability, the DeLone and McLean model is highly relevant. System Quality in this setting refers to how well the digital systems in libraries perform, including aspects like reliability, ease of use, and integration with existing services. Information Quality encompasses the accuracy, relevance, and timeliness of the digital content provided, which is essential for rural users who rely on libraries for access to current and comprehensive information. Service Quality, on the other hand, involves the support users receive, such as guidance from librarians, technical help, and responsiveness to user needs. These three quality dimensions directly affect both Use—how often and effectively users interact with digital services—and User Satisfaction—how content users are with the experience. When system usage and satisfaction are high, the library achieves Net Benefits, which may include increased digital literacy, better educational outcomes, community empowerment, and long-term sustainability of digital initiatives (Petter, DeLone, & McLean, 2008).

Table 2.5

Benefits of the DeLone and McLean IS Success Model in Evaluating Digital Technology in Rural Public Libraries

Benefit	Description	Relevance to Thesis
Comprehensive Evaluation Framework	Incorporates multiple dimensions (quality, usage, satisfaction, benefits).	Enables a holistic assessment of digital service effectiveness in rural libraries.

Benefit	Description	Relevance to Thesis
User-Centered Approach	Focuses on user satisfaction and usage behavior.	Focuses on user satisfaction and usage behavior.
Quality-Based Indicators	Emphasizes System, Information, and Service Quality.	Helps identify strengths and weaknesses in digital service delivery and infrastructure.
Measures Impact (Net Benefits)	Evaluates actual outcomes from IS use at individual and organizational levels.	Supports understanding of long-term sustainability and community impact.
Flexible and Widely Applicable	Applicable to various sectors including education, healthcare, and public services.	Suitable for rural library environments and digital service evaluation.
Theoretically Robust	Backed by extensive academic research and empirical validation.	Provides credibility and scholarly support for the theoretical foundation of your
Supports Continuous Improvement	Reveals feedback loops between satisfaction, usage, and service outcomes.	Encourages strategic planning and service enhancement in rural library systems.

Applying this model to the study offers a systematic approach to understanding the success of digital technology implementations in rural libraries. This research findings indicate strong user agreement regarding availability, usability, and satisfaction with digital library services, which aligns with the model's assumptions about the relationships between system quality, satisfaction, and perceived benefits. The dimension of Net Benefits is especially significant in your context, as it reflects the positive societal impact of digital services in underserved communities. For example, enhanced access to digital resources in rural libraries can reduce information gaps and support sustainable development goals through educational and technological empowerment. Therefore, the DeLone and McLean IS Success Model not only provides a theoretical foundation for evaluating user satisfaction but also aligns with the broader goals of digital equity and sustainability in rural public library settings (Urbach & Müller, 2012). This model effectively supports by linking system performance to user outcomes and long-term community benefits.

In conclusion, the DeLone and McLean Information System Success Model serves as a robust and multidimensional framework for evaluating the effectiveness of digital technology systems, particularly within the context of rural public libraries. Its

inclusion of system quality, information quality, service quality, use, user satisfaction, and net benefits allows for a nuanced understanding of how these technologies impact both individual users and organizational goals. By applying this model, this study can systematically assess the strengths and limitations of current digital services in rural libraries, thereby providing valuable insights for enhancing technological sustainability and user satisfaction. The model's flexibility and empirical backing make it particularly suitable for analyzing complex environments where digital access and literacy levels vary widely, such as rural communities. Its application in this thesis not only strengthens the analytical framework but also supports evidence-based recommendations for future digital library improvements (DeLone & McLean, 2003; Petter, DeLone, & McLean, 2008).

2.5.2 The Diffusion of Innovation

The Diffusion of Innovation (DOI) Theory, originally developed by Everett Rogers in 1962 and refined over decades, offers a powerful framework for understanding how innovations spread across social systems. At its core, DOI explains the process by which new ideas, practices, or technologies are communicated and adopted over time among members of a community (Rogers, 2003). The theory identifies five key attributes that influence the adoption of an innovation: Relative Advantage (the perceived benefit over existing solutions), Compatibility (the fit with existing values and practices), Complexity (the perceived difficulty of use), Trialability (the ability to test or experiment with the innovation), and Observability (the visibility of the innovation's outcomes). In addition, DOI categorizes adopters into five groups — innovators, early adopters, early majority, late majority, and laggards — recognizing that individuals vary in their willingness and speed to adopt new technologies. This temporal and social perspective makes DOI especially useful for analyzing innovation uptake in rural communities where access, exposure, and attitudes toward technology may differ from urban contexts.

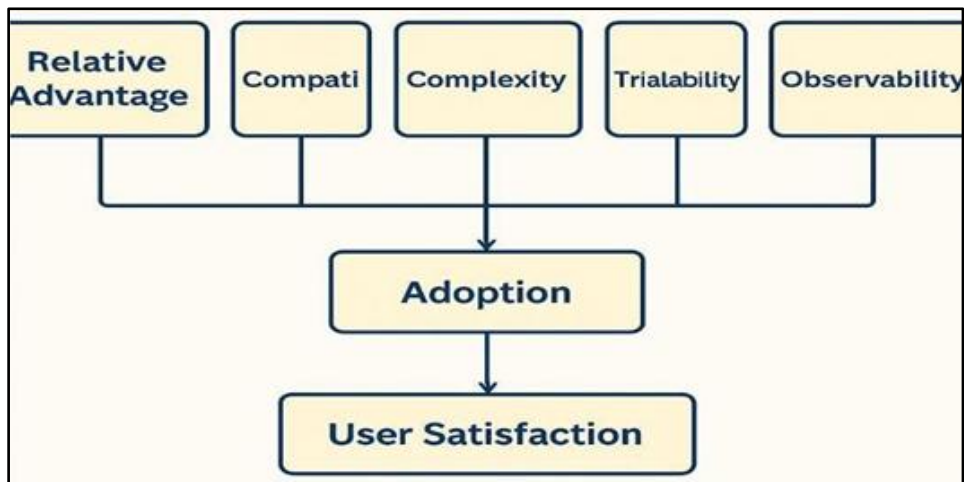


Figure 2.3 DOI Model

The customized Diffusion of Innovation (DOI) model developed for this thesis contextualizes Rogers’ original framework to reflect the unique dynamics of digital technology adoption in rural public libraries. In this adapted model, five core attributes—relative advantage, compatibility, complexity, trialability, and observability—shape the process through which digital technologies are adopted within these library environments. Relative advantage refers to the perceived improvements that digital tools bring compared to traditional services, such as faster access to information or expanded resources. Compatibility examines how well these technologies align with users’ needs, local culture, and digital literacy levels, while complexity addresses the ease or difficulty of using the systems. Trialability highlights the importance of allowing users to test new digital tools before full adoption, reducing perceived risk. Observability focuses on the visibility of the benefits, such as seeing community members successfully using e-resources or online services. Together, these attributes drive the adoption process, which in turn directly influences user satisfaction—a central concern in this study, as it mediates the long-term sustainability and effectiveness of digital services in rural libraries.

In the context of rural public libraries, the DOI framework is highly relevant for examining the introduction and sustainability of digital technologies. For example, relative advantage is reflected in the perceived improvements digital technologies bring to library services, such as faster access to information or more diverse resources. Compatibility examines whether digital services align with the needs, values, and capacities of rural library users, such as providing content in local languages or culturally relevant formats. Complexity highlights the importance of user-friendly

interfaces and support for low digital literacy populations, while trialability refers to opportunities for users to experiment with digital tools before fully committing. Observability addresses how visible the benefits of digital technology are to the community, such as seeing peers successfully using online resources or digital literacy programs. These DOI dimensions help explain why some rural libraries and users embrace digital services quickly, while others hesitate or resist adoption. Understanding these patterns is crucial for designing interventions that address barriers, promote awareness, and improve technology fit in rural settings (Rogers, 2003; Greenhalgh et al., 2004).

2.5.3 The Three Pillars of Sustainability Framework

Three pillars of sustainability framework were introduced by William Henry Clune and Alexander J. B. Zehnder in 2018. The three pillars of sustainability framework in this study are; 1) technology and innovation, 2) law and governance, and 3) economic and financial incentives. The economic section in this study stressed the economic welfare that measures growth rather than asset base which is supposed to be where growth depends. The authors also discussed the role of multidisciplinary analysis and planning in developing steps for changes in economy, technology, demography, and politics. The authors introduced these three pillars; technology innovation, laws governance and economics financial incentives as both sustainability challenges and sustainability actions and solutions.



Figure 2.4 Three Pillars of Sustainability Framework

Nonetheless, the Three Pillars of Sustainability Framework, introduced by William Henry Clune and Alexander J. B. Zehnder (2018), provides a holistic approach to understanding and addressing sustainability challenges. This framework is particularly relevant to the study of digital technology sustainability in rural public libraries (RPLs), as it emphasizes the interconnections of technology and innovation, law and governance, and economic and financial incentives. These three pillars serve as both sustainability challenges and sustainability actions and solutions, offering a comprehensive lens through which to analyze the adoption and long-term viability of digital technologies in RPLs.

2.5.3.1 Technology and Innovation

The first pillar, technology and innovation, focuses on the role of technological advancements and innovative solutions in achieving sustainability. In the context of RPLs, this pillar highlights the importance of adopting and integrating digital technologies to enhance library services and operations.

Table 2.6
Technology and Innovation

Digital Tools and Infrastructure:	
The adoption of digital tools such as e-books, online databases, and library management systems can significantly improve the efficiency and accessibility of library services.	However, rural libraries often face challenges such as limited infrastructure and technical expertise, which hinder the effective implementation of these technologies (Abu et al., 2024).
Innovative Solutions:	
Innovative approaches, such as mobile libraries, digital literacy programs, and partnerships with tech companies, can help overcome barriers to technology adoption.	For example, mobile libraries equipped with digital resources can reach remote communities, while digital literacy programs can empower users to utilize these resources effectively (Chowdhury, 2019).

2.5.3.2 Law and Governance

The second pillar, law and governance, emphasizes the role of policies, regulations, and institutional frameworks in promoting sustainability. For RPLs, this pillar underscores the need for supportive legal and governance structures to facilitate the adoption and sustainability of digital technologies.

Table 2.7
Law and Governance

Policy Support	
Government policies and regulations play a critical role in providing funding, resources, and technical support for rural libraries.	For instance, national digital inclusion policies can allocate funds for internet connectivity and digital infrastructure in rural areas (Abdullah & Kassim, 2019).
Institutional Frameworks	
Effective governance structures, such as library boards and advisory committees, can ensure that digital initiatives align with community needs and priorities.	These frameworks also facilitate collaboration between libraries, government agencies, and non-profit organizations (IFLA, 2018).

2.5.3.3 *Economic and Financial Incentives*

The third pillar, economic and financial incentives, focuses on the economic dimensions of sustainability, including funding, resource allocation, and financial viability. In the context of RPLs, this pillar highlights the importance of securing sustainable funding and economic support for digital initiatives.

Table 2.8
Economic and Financial Incentives

Funding and Resource Allocation	
Rural libraries often operate with limited budgets, making it difficult to invest in digital technologies.	Economic incentives, such as grants, subsidies, and partnerships with private sector organizations, can provide the necessary funding for digital infrastructure and programs (Singh & Mulla, 2021).
Economic Welfare and Growth	
The economic pillar stresses the importance of measuring growth in terms of economic welfare rather than asset base.	For RPLs, this means prioritizing investments that enhance user satisfaction, community engagement, and long-term sustainability over short-term asset accumulation (Clune & Zehnder, 2018).

In the context of RPLs, the Three Pillars of Sustainability Framework provides a comprehensive approach to addressing the challenges of digital technology adoption and sustainability.

2.5.4 **IASAM Model**

The Integrated Acceptance and Sustainability Assessment Model (IASAM) is a conceptual framework used to evaluate and analyze the acceptance and sustainability of projects, technologies, or initiatives within a given context. The creator of this model is Egils Ginters on the year 2018. This model highlights on ‘Sustainability’ that is divided into four dimensions: "acceptance", ‘management’, domain development and quality management. The "Integrated" aspect of the model signifies that sustainability and the dimensions interconnected and should be evaluated together. A project might be initially accepted but lack sustainability, or it might be sustainable but face

acceptance challenges (Eglis,2018). By assessing all dimensions holistically, decision-makers can make more informed choices and ensure that projects align with broader goals and values.

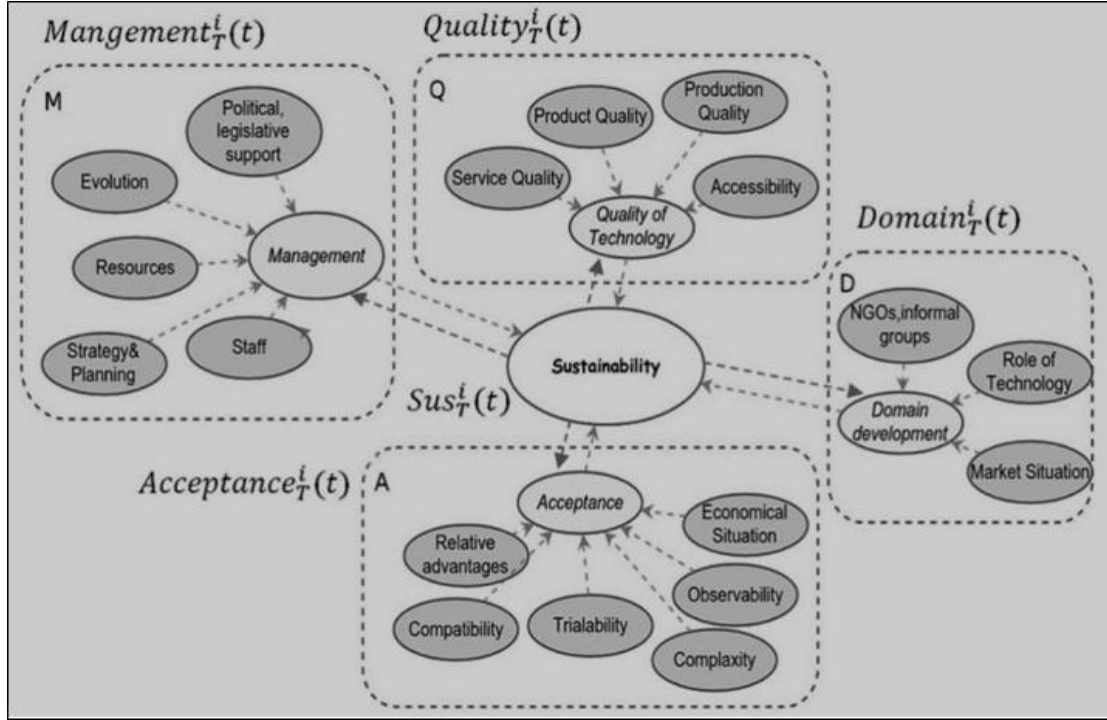


Figure 2.5 IASAM Model

The IASAM Model integrates environmental, social, and economic dimensions into decision-making processes, emphasizing the importance of stakeholder engagement in planning and implementing sustainable practices. It advocates for a life-cycle approach to asset management, which includes planning, implementation, monitoring, and evaluation, while promoting adaptive management practices that allow for flexibility and responsiveness to changing conditions. The IASAM Model is highly relevant to this study as it provides a structured framework for addressing the sustainability challenges of digital technologies in rural public libraries (RPLs). By applying this model, the research explores how an integrated approach to digital technology sustainability can enhance the effectiveness and long-term viability of RPLs. Specifically, the study aims to provide actionable recommendations for life-cycle management and adaptive management practices, ensuring the sustainable adoption, maintenance, and evolution of digital technologies in rural libraries.

The discussion on relevant theories and models has established a comprehensive foundation for understanding the adoption, effectiveness, and sustainability of digital technology in rural public libraries (RPLs). Theories such as the Diffusion of Innovation (DOI) and Delone and Mclean IS success model emphasize the importance of perceived usefulness, ease of use, and facilitating conditions in shaping technology adoption among librarians and users. Meanwhile, the SERVQUAL model highlights the role of service quality in determining user satisfaction, which is crucial for the long-term sustainability of digital initiatives in RPLs. These theoretical perspectives collectively underscore the need for an integrated approach that considers technological infrastructure, awareness, usage behavior, and service effectiveness. Building on this foundation, the next section presents the Development of the Conceptual Framework, which structures the relationships between digital technology implementation, librarian perspectives, user satisfaction, and sustainability outcomes in RPLs. This framework will provide a structured basis for hypothesis formulation and empirical investigation, ensuring a holistic understanding of digital technology sustainability in the rural public library context.

2.6 Literature Gaps

Despite a significant increase in study on digital technology in libraries, there are still several important gaps, especially when considering public libraries in rural Malaysia. First, whereas a large portion of the research has focused on digital adoption or user satisfaction in public libraries (Islam & Ahmed, 2020; Yusof & Rahman, 2022), very few studies have thoroughly investigated librarians' viewpoints. Since librarians are directly in charge of implementing, maintaining, and managing digital technologies, this is a significant omission. Additionally, their challenges such as inadequate training, a lack of resources, and challenges in raising awareness have not been sufficiently examined (Abdullah & Kassim, 2019; Hashim & Ismail, 2023).

Second, existing research on rural libraries under-represent the awareness dimension, despite its established importance in technology adoption. Although many Malaysian library studies examine digital usage or satisfaction, they often overlook how awareness shapes users and librarians' engagement with digital services. This omission is critical because theoretical models such Diffusion of Innovation (Rogers,2023) identify awareness as the foundational stage of adoption, influencing whether

individuals even recognize or attempt to use available technologies. Empirical studies in Malaysia and abroad demonstrate that low awareness contribute to the chronic underutilization of digital resources, ultimately weakening sustainability efforts and diminishing the impact of national digital initiatives (Rahman & Lim 2022; Park Lee, 2020). The lack of focused investigation into awareness, particularly in rural settings where digital exposure is already limited, reveals a significant gap in literature. This underscores the need to position awareness as a core construct in evaluating digital technology sustainability in rural public libraries, especially within contexts like Pahang where disparities in digital readiness remain pronounced.

Third, the complexity of sustainability in rural public libraries is difficult for current research to fully grasp because they frequently rely on a single theoretical model. Although it is frequently used to evaluate system quality, information quality, and user happiness, the DeLone and McLean IS Success Model (2003) ignores awareness. Although awareness and adoption are covered in *The Diffusion of Innovation* (Rogers, 2003), contentment is not mentioned as a mediating factor. Although it highlights economic, social, and environmental aspects, the Three Pillars of Sustainability approach does not specifically address how digital technology is maintained in libraries. As a result, no one theory can adequately describe how awareness, utilization, happiness, and sustainability are all interconnected in the context of RPL.

Based on these gaps, this study advances literature in three keyways. First, it integrates both librarian perspectives and user satisfaction, providing a dual lens to examine digital technology sustainability in Pahang's rural public libraries. Second, it highlights the critical role of awareness as a distinct construct that influences both adoption and sustainability. Third, it combines elements of the IS Success Model, the Diffusion of Innovation, and the Integrated Acceptance and Sustainability Assessment Model (IASAM) into a comprehensive framework tailored to the rural Malaysian context. This integrative approach not only addresses existing theoretical limitations but also provides practical insights for policymakers and practitioners seeking to strengthen the sustainability of digital services in rural libraries.

2.7 Development of Conceptual Framework

The development of a conceptual framework is essential in structuring this study's investigation into librarian perspectives and user satisfaction on digital technology sustainability in rural public libraries (RPLs). Grounded in the theoretical foundations discussed earlier, this framework integrates key elements that influence the successful adoption and long-term sustainability of digital technologies in RPLs.

Specifically, it examines how digital technology implementation, librarian awareness and engagement, user satisfaction, and sustainability strategies interact to shape the overall effectiveness of digital library services. By systematically organizing these interrelated factors, the conceptual framework provides a guiding structure for empirical analysis and hypothesis development, ensuring a comprehensive understanding of the dynamics that contribute to sustainable digital transformation in RPLs. The following subsections outline the core components of this framework, detailing the role of digital technology works, technology awareness and usage, user satisfaction, and digital technology sustainability, followed by hypothesis formulation based on these relationships.

2.7.1 Discussion on Conceptual Framework of Librarian Perspectives and User Satisfaction on Digital Technology Sustainability in the Rural Public Library

The development of a conceptual framework is essential in structuring this study's investigation into librarian perspectives and user satisfaction on digital technology sustainability in rural public libraries (RPLs). Grounded in the theoretical foundations discussed earlier, this framework integrates key elements that influence the successful adoption and long-term sustainability of digital technologies in RPLs. Specifically, it examines how digital technology implementation, librarian awareness and engagement, user satisfaction, and sustainability strategies interact to shape the overall effectiveness of digital library services. By systematically organizing these interrelated factors, the conceptual framework provides a guiding structure for empirical analysis and hypothesis development, ensuring a comprehensive understanding of the dynamics that contribute to sustainable digital transformation in RPLs.

The conceptual framework for this study is designed to explore the interplay between librarian perspectives, user satisfaction, and digital technology sustainability in rural public libraries (RPLs). It integrates key concepts such as digital technology works, technology awareness and usage, user satisfaction, and RPL digital technology sustainability to provide a comprehensive understanding of how these factors influence the adoption and long-term viability of digital technologies in rural libraries. Below is a detailed discussion of each component of the conceptual framework, with subsections outline the core components of this framework, detailing the role of digital technology works, technology awareness and usage, user satisfaction, and digital technology sustainability, followed by hypothesis formulation based on these relationships.

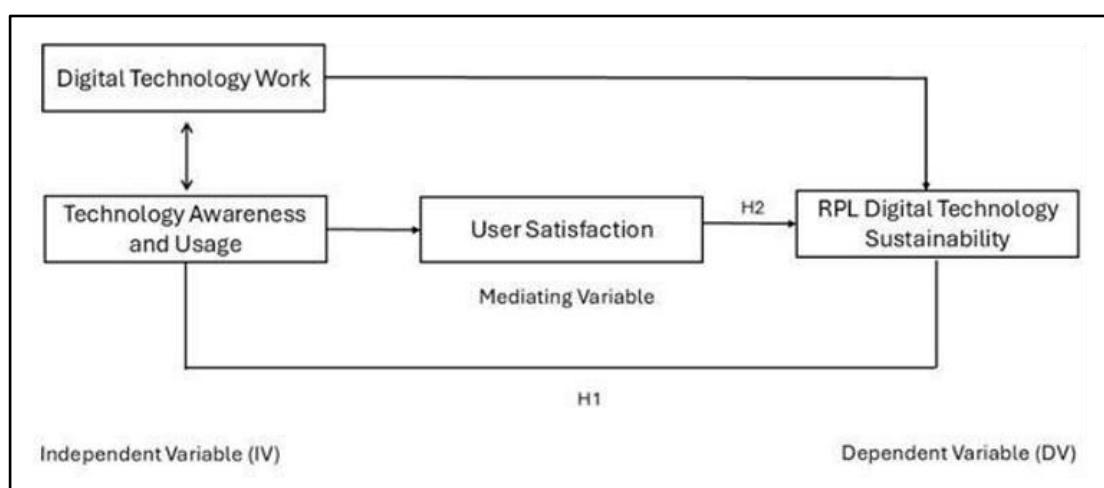


Figure 2.6 Conceptual Framework of Librarian Perspectives and User Satisfaction on Digital Technological Sustainability in the Rural Public Library

2.7.1.1 *Digital Technology Works (Digital Literacy, Collaboration and Partnership, Community Engagement).*

The implementation of digital technology in rural public libraries encompasses various hardware, software, and digital services designed to enhance information accessibility and library efficiency. These include digital repositories, e-books, online catalogs, AI-driven chat- bots, and RFID-based automation systems. The effectiveness of these digital technologies depends on infrastructure quality, internet connectivity, and institutional support. This component of the framework examines how well digital technology functions in RPLs and whether it aligns with users' and librarians' needs.

a) Digital Literacy

Digital literacy enables library staff and users to effectively use digital tools for accessing, evaluating, and sharing information. In RPLs, digital literacy programs empower underserved communities by teaching skills for e-learning, digital archives, and online services. Librarians must also be digitally competent to integrate technology into library operations seamlessly.

b) Collaboration and Partnership

Strategic partnerships with governments, educational institutions, and tech providers are vital for RPLs. These collaborations offer funding, training, and technical support, enabling libraries to expand digital services. Partnerships also facilitate knowledge exchange, resource sharing, and capacity- building, ensuring the sustainability of digital initiatives in rural areas.

c) Community Engagement

Community engagement ensures digital services in RPLs are inclusive and relevant. Libraries must address local needs through workshops, outreach, and feedback mechanisms. Active community involvement fosters ownership, encourages digital adoption, and helps tailor services to meet cultural and socioeconomic contexts, ensuring long-term sustainability.

2.7.1.2 Technology, Awareness and Usage

Technology awareness and usage are key determinants of digital technology sustainability in RPLs. Technology awareness refers to the extent to which librarians and users understand the benefits and functionalities of digital tools, while technology usage refers to the frequency and effectiveness of their use. In rural libraries, low levels of technology awareness and usage can hinder the adoption and sustainability of digital technologies. This study examines how awareness and usage patterns influence the success of digital initiatives and identifies strategies for improving both. For example, training programs and community outreach initiatives can enhance technology

awareness, while user-friendly interfaces and reliable infrastructure can encourage greater usage.

2.7.1.3 *User Satisfaction*

User satisfaction is a key indicator of the success and sustainability of digital technology in libraries. It reflects how effectively digital services meet user expectations in terms of accessibility, ease of use, service quality, and relevance. Satisfaction levels can influence user retention, engagement, and advocacy for digital services. By examining user satisfaction, this framework assesses whether current digital technologies enhance the overall library experience and contribute to sustainable library operations.

2.7.1.4 *RPL Digital Technology Sustainability*

Sustainability in the context of digital technology in rural public libraries refers to the long-term viability and effectiveness of digital services. It depends on factors such as funding, infrastructure maintenance, technological advancements, policy support, and continuous user engagement. Sustainable digital technology ensures that RPLs remain relevant, accessible, and capable of serving diverse communities without constant reliance on external interventions. This section of the framework explores the interplay between digital technology implementation, librarian engagement, user satisfaction, and institutional support in sustaining digital initiatives within RPLs.

2.7.2 *Hypotheses*

The research design used in this study is an exploratory sequential approach, with the quantitative phase (user survey) testing the relationships between sustainability, awareness, usage, and user satisfaction, and the qualitative phase (library interviews) exploring challenges, opportunities, and perceptions regarding the sustainability of digital technology. No assumptions are developed for the librarian perspective because it is approached qualitatively. Rather, thematic analysis of librarian data is used to pinpoint important problems and offer context.

As a result, the hypotheses are restricted to the quantitative part and center on rural public library patrons. Two theories are put forth in light of the integrated framework that incorporates elements from the IS Success Model, Diffusion of Innovation, and IASAM:

- H1 : Awareness of digital services has a significant positive effect on the sustainability of digital technology in rural public libraries.
- H2 : User satisfaction mediates the relationship between awareness, usage, and the sustainability of digital services in rural public libraries.

While acknowledging that librarians' qualitative insights assist, clarify, and contextualize the quantitative findings, the study preserves methodological consistency by limiting hypotheses to the quantitative strand. This strategy makes sure that both aspects—user satisfaction and librarian perspectives—are suitably covered in a mixed-method framework without imposing hypotheses where they are not methodologically acceptable.

2.8 Summary of Chapter

This chapter has provided a comprehensive review of literature related to digital technology sustainability in rural public libraries (RPLs), with a specific focus on the roles of librarians and user satisfaction. The review explored fundamental principles and concepts, including the evolving role of librarians in promoting digital literacy, the factors influencing user satisfaction, and the challenges and opportunities associated with digital technology adoption in RPLs. It also examined the library digital technology sustainability plan in Malaysia, highlighting the unique socioeconomic and technological landscape of the region. The chapter reviewed key qualitative and quantitative theories and models, such as thematic analysis, DeLone and McLean IS Success Model, Diffusion of innovation (DOI), the Three Pillars of Sustainability Framework, and the IASAM Model. These models provided a theoretical foundation for understanding the factors that drive technology adoption, usage, and sustainability in RPLs.

Finally, the chapter developed a conceptual framework that integrates digital technology works, technology awareness and usage, user satisfaction, and RPL digital technology sustainability. This framework, along with the formulated hypotheses, guides the study's investigation into how these factors interact to influence the sustainability of digital technologies in rural libraries.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlines the research methodology employed to evaluate user satisfaction with digital technology sustainability in rural public libraries (RPLs) across Malaysia. This chapter details the research design, data collection methods, sampling techniques, and analytical approaches used to explore how technology awareness, technology usage, service quality, and user satisfaction influence the sustainability of digital services in RPLs.

3.2 Design of Research

This study adopts an exploratory sequential mixed-methods design, beginning with a qualitative phase to explore the perspectives of librarians, followed by a dominant quantitative phase that tests the relationships among awareness, user satisfaction and sustainability from user perspective. This design is appropriate because the sustainability of digital technology in rural public libraries is shaped by operational challenges that must be understood first qualitatively before they can be measured statistically. Thus, the qualitative phase provides contextual depth, while the quantitative enables generalization and hypothesis testing.

Phase 1 (Qualitative) involved semi-structured interviews with rural librarians selected through purposive sampling to capture diverse library settings and community contexts across Pahang. Thematic analysis was conducted following Braun and Clarke's (2006) six phase framework: familiarization, coding searching for themes, reviewing themes, defining themes and reporting. Key themes that emerged such as resource limitations, training needs, digital awareness strategies and infrastructure disparities. It provides critical insights into the operational realities of digital technology sustainability. These findings were not intended for hypothesis development but to ensure that the study's quantitative measures accurately reflected the lived challenges of rural librarians. The qualitative phase therefore served as the foundation for constructing and refining survey instruments.

Phase 2 (Quantitative) used a structured questionnaire distributed to users rural public libraries in Pahang. Items were adapted from validated models in digital adoption and sustainability research and refined based on qualitative themes identified in Phase 1 to strengthen contextual relevance. The instrument was reviewed and validated by experts from the National Library of Malaysia (PNM). Quantitative data were analyzed using descriptive statistics, normality testing, ANOVA and structural equation modelling (SEM) to examine the hypothesized relationships among awareness, usage satisfaction and sustainability. Integration occurred at two key points:

- a) During instrument development, where qualitative findings informed item construction and;
- b) During interpretation, where qualitative themes were used to contextualize and explain qualitative results. This integrated design ensures a comprehensive and methodologically robust understanding of digital technology sustainability in rural public libraries.

3.2.1 Type of Research

There are various types of research in social science fields that have been used by other researchers in constructing their research. Quantitative research, quantitative research and mixed methods approaches are commonly used in social science research. Qualitative research refers to exploring and understanding the meaning of the individual and group that contributes towards the social or human problem (Cresswell, 2014). When researchers want to comprehend social issues from the viewpoints of people or groups in their natural environments, this approach is especially helpful. This research will assess the viewpoint of the people regarding their experiences, behavior, and opinions by conducting the interview session and collecting the non- numerical data such as text, audio, video, and any related materials related to the people. This methodology is essential to get a comprehensive and in-depth understanding of the topic of the study.

Quantitative research approach deals with numerical data or which can be converted into numbers (Sheard, 2018). A quantitative approach allows for the systematic collection and analysis of numerical data, which is essential for identifying patterns and relationships between variables such as technology awareness, technology

usage, service quality, and user satisfaction (Creswell, 2014). The process involved in this methodology is collecting numerical data, analyzing, examining the relationship between the variables existed in the study and generalized by drawing the conclusion based on the data that has been collected by the researchers. In the quantitative research, the social science researcher will analyze the quantitative data by conducting descriptive statistics to measure the average and variability, while using inferential statistics to examine the relationship between the variables for hypothesis testing for the variables that have been constructed by the researchers. This researcher approaches significantly to assess the huge population and analyze the patterns shown from the quantitative data that has been gathered by the researchers.

While mixed method research defines as the research where the researcher collects, analyzes and integrates both qualitative and quantitative data in study (Creswell and Clark, 2017). This method will give a deep and comprehensive understanding of the research problem by combining and integrating the qualitative research approaches and quantitative research approaches in one of the research topics. Qualitative research refers to exploring and understanding the meaning of the individual and group that contributes towards the social or human problem (Cresswell, 2014). According to Lima and Newell-McLymont (2021) qualitative research has been seen as interpretive research. This research methodology requires interpreting human behavior and experience related to human problems. While the quantitative research approach is in contrast with the qualitative research approach, in which it deals with numerical data or data that can be converted into numbers (Sheard, 2018).

In this study, the mixed method research approaches will be adopted and employed in assessing the current state of digital technology sustainability in rural public libraries in Pahang, with a focus on understanding librarian perspectives and user satisfaction. This methodology will be combined to get deep understanding and comprehensive data to understand the good practices on sustainable digital technologies in rural public libraries. In the first phase of the study will adopt the qualitative research approaches and be followed by a quantitative research approach. Qualitative research approaches, including interview, observation, and document analysis, will be used to investigate the availability, awareness, and usage of digital technologies in these libraries, particularly on librarians' perspectives. Meanwhile, the quantitative research approach includes surveys and questionnaires in assessing the user satisfaction with the library's services within the rural public library. Based on the integration of this

research approaches, this research will give the researchers a comprehensive understanding of the librarian perspectives on the digital technologies within the library services in rural public libraries as well as user satisfaction on the library services in the rural public libraries, particularly in Pahang State.

3.2.2 Research Paradigm

Research paradigms refer to the theoretical and philosophical ground for the research work (Khatri, 2020). Different kinds of research use different research paradigms. There are three main components of the research paradigm which are positivism, interpretivism and pragmatism. In quantitative research, the research paradigm is positivism. According to Park, Konge & Artino (2020), positivism refers to the hypothetical-deductive method to verify priori hypotheses that have been constructed quantitatively, in which it examines the relationship that was derived between causal and explanatory factors (independent variables) and outcomes (dependent variables). While the qualitative research used the interpretivism of the research paradigm. Interpretivism underlies the studies that research aims to understand the meaning and interpretation on the way that people of individuals assign based in their experience (Jansen, 2023). While the research paradigm for mixed method approaches is pragmatism. Pragmatism is based on the proposition that one should use the philosophical and/or methodological approach that works best for the research problem that is being investigated (Tashakkori and Teddlie, 1998). The usage of the research paradigm is dependent on the nature of the research as well as the data that will be collected. Besides that, it also shows what kind of knowledge the researcher wants to obtain by conducting the research.

In this study, the researcher employed pragmatism for the mixed methods of research approaches. Pragmatism is based on the proposition that should use the philosophical and/or methodological approach that works best for the research problem that is being investigated (Tashakkori and Teddlie, 1998). It is commonly associated with mixed-methods research, as it allows researchers to use different methodologies based on what best addresses the research question. The major underpinning of pragmatism is knowledge that is associated with the experience of individuals as well as the numerical data gathered based on quantitative research. The combination of these research approaches will enhance the value shown in that study. This study will assess

the librarian perspective on the availability of digital technologies on library services as well as examine the user satisfaction on the rural public library in utilization of the uses of digital technologies. The use of this research paradigm will give various kinds of data that could contribute to the development of libraries towards sustainability towards the society and nation particularly in Malaysia.

3.2.3 Research Process

According to Nunamaker et al (1990) the research process involved the process of understanding the research domain, answering the research question and applying the right and appropriate research methodology in answering the research question. The research process represents the development of the research based on the selected methodology. The database figure below shows several basic mixed methods of research design adapted from Creswell (2014) that consist of three basic processes which are convergent parallel design, explanatory sequential design and exploratory sequential design. A convergent parallel design shows the researcher must simultaneously perform the quantitative and qualitative components at the same phase of the research process, weigh the methodologies equally, analyze the two components separately, and interpret the results (Creswell & Pablo-Clark, 2011). Explanatory sequential research in mixed methods research shows the researcher conducting the data collection and analyses for quantitative data and followed by conducting the qualitative data collection and analysis. This is defined by Edmonds and Kennedy (2016) an explanatory-sequential approach refer to a sequential approach and the researcher is likely to get follow-up on the quantitative result with qualitative data. While an exploratory sequential design refers to the research process in the qualitative phase of data collection and analysis will be followed by the quantitative data collection and analysis (Fetters, Curry, & Creswell, 2013). The flow of research has been shown below:

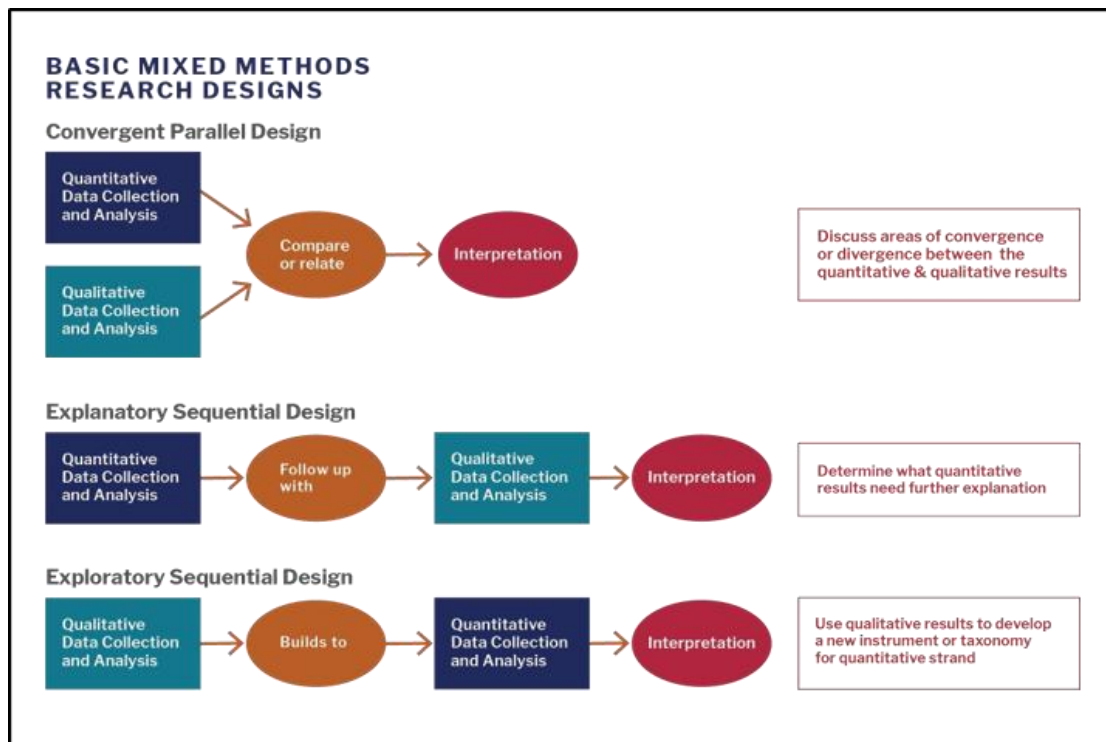


Figure 3.1 Basic Mixed Methods Research Design

Source: Creswell, 2014

In this study the exploratory sequential design has adopted in which the phase began by conducting the qualitative data collection and analysis and followed by quantitative data collection and analysis. In the phase of data collection, the qualitative research approach was conducted by interviewing the librarian in Rural Public Libraries in Pahang state. The component that was highlighted during the interview session consists of digital literacy, collaboration and partnership as well as community engagement. While, in the second phase of data collection analysis is a quantitative research approach where the survey was conducted to identify the user perspective on digital technology within the library services particularly the user who visited the rural public library in Pahang State. The data analysis has been implemented after the data collection was completed to interpret the results for both phases. The discussion was conducted after the results for the qualitative data produced by the transcription and the analysis data for quantitative data was conducted.

3.3 Population and Sampling

Population refers to the entire group of population while sample refer to subset of population (Banerjee & Chaudhury, 2010). The populations consist of the group of individuals who have various characteristics that have been assessed to achieve the objectives of the study. While sample refers to the subset of the population that has been studied by the researchers.

3.3.1 Population

Malaysia's rural population faces unique challenges regarding digital technology access and usage, as the digital divide between urban and rural areas remains significant (Rahman, 2021). The rural public libraries in Malaysia play a crucial role in bridging this gap by offering access to essential digital resources that users might not otherwise have. In this study will focuses on the Rural Public Library of Pahang state, Malaysia. The study focuses on investigating the availability, awareness, and usage of digital technologies in these libraries, as well as their impact on user satisfaction and long-term sustainability. The population of librarians in rural public library at Pahang is 28.

While another respondent who participated in this study is library users. The rural population in Pahang is 751,660 of population has been shown in the table below. The focus on rural public library users is particularly relevant given the Malaysian government's push toward improving digital access and literacy in rural areas, as part of their broader digital transformation agenda (Salleh & Sulaiman, 2022). The population includes users from various demographic backgrounds, such as different age groups, education levels, professions, and levels of digital literacy. These users are assumed to rely on public library services not only for traditional resources but also for digital tools such as e-books, online databases, digital catalogues, and internet access. The librarian and RPL user play significant role in making sure the rural public library will stay relevant in the future.

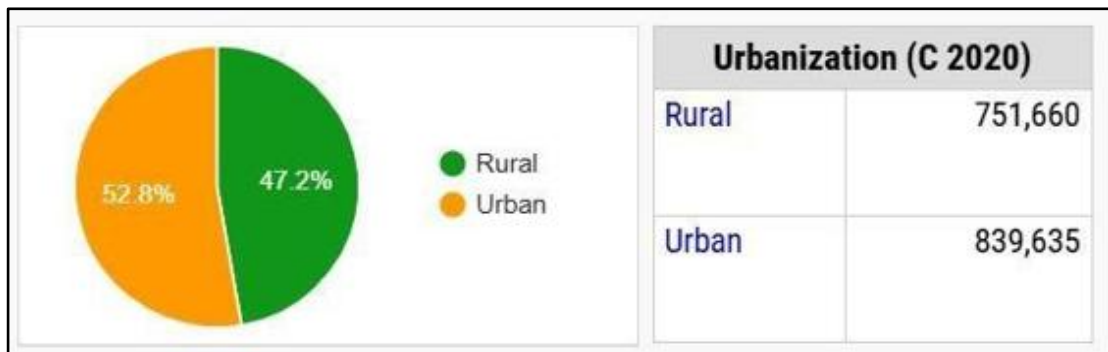


Figure 3.2 The Number of Populations in Pahang state

Source: City Population website, 2023

3.3.2 Sampling

Sampling refers to the act, process and technique in selecting the suitable sample from the entire population (Verma et al, 2017). There are various types of sampling in conducting the research in mixed methods research approaches. It is essential for mixed methods of research to ensure the findings are reliable and applicable based on research topics. There are two major samplings techniques which are probability sampling and non-probability sampling. In probability sampling, the researcher could specify the probability that the respondent or participant includes in this sample (Verma et al, 2017). While in non-probability sampling, these sampling techniques are convenient for the researcher to assemble a sample with little or no cost and/or for those research studies that do not require representatives of the population (Latham, 2007). In probability sampling, several techniques can be used by researchers consist of including random sampling, stratified random sampling, systematic random sampling, cluster sampling while, in non-probability sampling consist of convenience sampling, purposive sampling, snowball sampling and quota sampling.

In this study, the sampling technique that has been used is purposive sampling. This sampling is under the non-probability sampling techniques. Purposive sampling refers to the techniques in which the researcher consciously selects certain people to include in this study (Verma et al, 2017). The informants and participants were selected because of their characteristics that were suitable based on the researcher's study. The sample size of each of the phases of data collection has a different number of informants and respondents. In qualitative data collection, the number of informants only **eight (8)** of the librarians that participated in this study as well as eight (8) location of rural public

libraries, particularly in Pahang state. The sample size is sufficient because of their position and experience related to managing rural public libraries in Pahang state. This link with the statement by that state the traditional qualitative research practices utilized the fixed numerical thresholds in which a commonly suggested sample size within 5 – 30 participants per group (Guest, Bunce, and Johnson (2006). Table 3.1 below shows the indicator and location of RPL that has already been assessed in this study:

Table 3.1
Number of Sample

No	Indicator of the Informants	Position	Organization
1	RPL1	Assistant Librarian (S29)	Perpustakaan Desa Bandar Indera Mahkota (Zon C 01)
2	RPL2	Assistant Librarian (S29) / Supervisor Zon 2	Perpustakaan Desa Kg. Teluk Sentang
3	RPL3	Assistant Librarian (S29)	Perpustakaan Desa Seberang Chenor
4	RPL4	Assistant Librarian (S29) / Supervisor Zon 4	Perpustakaan Desa PNM Kg New Zealand
5	RPL5	Assistant Librarian (S29)	Perpustakaan Desa PNM Kampung Bukit Betong
6	RPL6	Assistant Librarian (S29)	Perpustakaan Desa Kg Perpat
7	RPL7	Assistant Librarian (S29)	Perpustakaan Desa Kg Pulau Rusa
8	RPL8	Assistant Librarian (S29) / Supervisor Zone 9	Perpustakaan Desa Masjid Kg Relong

In the second phase data collection, quantitative research approaches will be conducted among the library user who have been recommended by librarians, as well as staff that frequently visited in this RPL. Based on the population, the rural population in Pahang state is 751,660. Therefore, based on the population, the sample size calculator shows the maximum recommended sized on the study. Figure below shows the sample size calculator known as Roasoft was used to determine the recommended sample size for this study. Based on Roasoft, the recommended sample size is 384 with 95% of the confidence level based on the recommendation from Roasoft. Besides that, the researcher has divided each of the RPL to explore the user satisfaction and librarian perspective for the digital technology availability in RPL. Each of the RPL is required to recommend the library users in this study. Purposive sampling was employed to

select participants, focusing specifically on librarians and users from rural public libraries (RPLs) in Pahang, Malaysia.

Purposive sampling was employed to select participants, focusing specifically on librarians and users from rural public libraries (RPLs) in Pahang, Malaysia. The sample size was determined using the Raosoft online calculator, targeting a 95% confidence level and a 5% margin of error, which ensures that the findings are statistically representative of the population. A total of 385 respondents were required to achieve adequate statistical power for the quantitative analysis. For the qualitative phase, librarians were selected based on their experience in managing digital services in rural libraries.

Raosoft® Sample size calculator	
What margin of error can you accept? 5% is a common choice	5 %
What confidence level do you need? Typical choices are 90%, 95%, or 99%	95 %
What is the population size? If you don't know, use 20000	751660
What is the response distribution? Leave this as 50%	50 %
Your recommended sample size is	384

The margin of error is the amount of error that you can tolerate. If 90% of respondents answer yes, while 10% answer no, you may be able to tolerate a larger amount of error than if the respondents are split 50-50 or 45-55. Lower margin of error requires a larger sample size.

The confidence level is the amount of uncertainty you can tolerate. Suppose that you have 20 yes-no questions in your survey. With a confidence level of 95%, you would expect that for one of the questions (1 in 20), the percentage of people who answer yes would be more than the margin of error away from the true answer. The true answer is the percentage you would get if you exhaustively interviewed everyone. Higher confidence level requires a larger sample size.

How many people are there to choose your random sample from? The sample size doesn't change much for populations larger than 20,000.

For each question, what do you expect the results will be? If the sample is skewed highly one way or the other, the population probably is, too. If you don't know, use 50%, which gives the largest sample size. See below under **More information** if this is confusing.

This is the minimum recommended size of your survey. If you create a sample of this many people and get responses from everyone, you're more likely to get a correct answer than you would from a large sample where only a small percentage of the sample responds to your survey.

Figure 3.3 Sample Size Calculator

Source : Raosoft website, 2025

3.4 Sampling Criteria

The sampling criteria represent the inclusion and exclusion criteria that participants would participate in in this study. The researcher specifies the characteristics of the respondents that are suitable to be investigated in this study. These criteria have been selected based on the suitability with the topic of the research study. The qualities of the informants and respondents have been assessed based on the inclusion and exclusion criteria.

3.4.1 Inclusion Criteria

The informants should meet the following criteria and conditions will be included in this study. As follows the criteria and conditions for the librarians:

- a) Age - between the age of 18 years old until 56 years old and above.
- b) Position – Supervisor and librarian in Rural Public Library of Pahang state.
- c) Library Professional – individual who working as the librarian who also the supervisor at the rural public library particularly in Pahang state.
- d) Experience with Digital Technology Sustainability – the library professional or librarian who have experience in handling the program related technologies in rural public libraries in rural area in Pahang state.
- e) Willingness to participation – the library professional or librarians who willing to share the information related with the program and activities in rural public libraries in rural area in Pahang state.

While the following component is the criteria and conditions that will be included in this research among library users. The criteria and conditions are as follows:

- a) Age – within the age of 18 years old until 56 years old and above.
- b) Library user - The criteria of library user are the individuals who regularly use rural public libraries (RPLs) in Malaysia and engage with their digital technology services.
- c) Experience in using library services - library patrons who have used these services within the past year, ensuring that they have recent and relevant experiences to share.

3.4.2 Exclusion Criteria

The informants should meet the following criteria and conditions will be excluded in this study. As follows the criteria and conditions for the librarians:

- a) The study only focuses on rural public libraries, so professionals from rural

library or state libraries excluded from this study.

- b) The supports staff or technical staff in Rural Public Library
- c) The respondent who has limited knowledge in handling programs or activities related with digital technology sustainability.

While the following component is the criteria and conditions that will be excluded in this research among library users. The criteria and conditions are as follows:

- a) Library users are below 18 years old.
- b) Individual who infrequently visited the rural public library
- c) Individuals within the community did not participate in any program and activity related with digital technology by rural public libraries.

3.5 Instrument Development

According to Lasmana et al (2024), the research instrument commonly been used by the researcher to refer to measurement tools like questionnaire, survey and interview guide. show that the research instrument represents the tool or method used to collect data in a research study. Research instruments can take various forms, including surveys, questionnaires, interviews, observation protocols, tests, and measurement scales.

3.5.1 Interview Guide Developments

The interview guide was developed to investigate the current state of digital technology availability to enhance user satisfaction with rural public library sustainability. In achieving the first research objectives, the researcher is already conducting the interview session with the librarian or supervisor of the rural public library in Pahang state. In this interview guide, there are three main themes for the interview guide which are digital literacy program, collaboration and partnership, and community engagement. The theme digital literacy will assess and explore the activities or programs that were organized by the rural public library towards developing the digital technology skill among library users. The collaboration and partnership to assess the collaboration exists between rural public libraries with other government or private

organizations. While the themes of community engagement have assessed the engagement exists between rural public libraries' staff with the library user who frequently visit the library within their rural areas.

Table 3.2
Interview Guide for Digital Literacy Programs, Collaboration and Partnership, and Community Engagement

Themes	Question
Digital Literacy Program	1. Does the RPL organize any programs, workshops, or activities that focus on developing users' digital technology skills? 2. Does RPL organize any programs, workshops, or activities that focus on developing users' computer literacy skills? 3. Does RPL organize any programs, workshops, or activities that focus on educating users about internet browsing? 4. Does RPL organize any programs, workshops, or activities that focus on educating users about online safety?
Collaboration and Partnership	1. Does RPL establish any form of partnership to foster continuing education with local agencies, institutions, associations, or businesses? 2. Does RPL collaborate with local agencies, institutions, associations, or businesses to obtain specific funding, donations, or support to enable RPL to achieve digital advancement?
Community Engagement	1. Does the PD interact with consumers to understand their digital technology service options?

3.5.2 Questionnaire Developments

The questionnaire used in this study was developed by adapting items from established adoption and sustainability models, including the Information System (IS) Success Model (DeLone & McLean, 2003), the Diffusion of Innovation theory (Rogers, 2003), and the Integrated Acceptance and Sustainability Assessment Model (IASAM) (Ventaksh et al., 2018). Several items were also drawn from past studies on technology use and satisfaction in libraries (Islam & Ahmed, 2020; Yusof & Rahman, 2022; Hashim & Ismail, 2023) to ensure theoretical alignment and contextual relevance. The questionnaire consisted of four sections: Section A (demographics), Section B (awareness and use of technology), Section C (satisfaction with digital services), and Section D (sustainability and advancement of technology). To ensure validity and

reliability, the questionnaire was reviewed by experts from the National Library of Malaysia (PNM). Their feedback helped refine the wording, structure, and contextual suitability of the items for the rural public library environment in Pahang. This verification process strengthens the credibility of the instrument and ensures that it accurately reflects both theoretical constructs and practical realities.

Developing the questionnaire for this research provides an efficient, cost-effective, and accessible method to collect data from participants in rural communities. The study has adopted several components or elements based on previous models in developing the questionnaire. The Delone and Mclean IS Success Model was a structure framework in examine the adoption of the technology among individuals or communities. Therefore, there are several components and elements that have been adopted in developing this question. There are three components that have been adopted based on the mentioned model to be employed to this questionnaire consist of Performance, Facilitating Condition & Experience. While two components have been taken from the DOI model consist of Perceived Ease of Use and Perceived Usefulness. The justification on the selection of these components and elements because to measure the technology awareness and usage could support the digital technology sustainability within the rural public library particularly in Malaysia.

In this study, the questionnaire will be designed to evaluate user satisfaction with digital technology sustainability in rural public libraries (RPLs) across Malaysia. Given the widespread use of mobile devices and increasing internet connectivity, even in rural areas, questionnaires in the form of Google Forms ensure that respondents can easily participate, whether from home or at their local library. The questionnaire will include sections that measure key variables, such as technology awareness, technology usage and digital technology sustainability in RPL with digital library services. Each section will feature a Likert-scale, designed to capture both quantitative insights. Additionally, questionnaires in form of Google Forms allow automatic data collection and organization, which will streamline the process of managing and analyzing responses, ensuring that the research is both time- and cost-effective while maintaining data integrity (Evans & Mathur, 2018). This tool aligns with the study's focus on technology sustainability, emphasizing the use of digital solutions to address community needs.

Table 3.3

Questionnaire Development for Technology Awareness and Usage

Operation Definition	Measurement	Source
Technology Awareness and Usage		
Technological Awareness Refers to user understanding and familiarity with the existence, use and benefits of digital technology services provided by Rural Public libraries.	1. I Know about Integrated Digital Technology in Rural Libraries	DOI
Technological Usage Refers to the extent and way users interact with and apply digital technologies in rural public libraries.	1. Internet access speed is the main reason why I go to the village library. 2. Digital resources in the village library are the main reason why I go to the village library 3. I had positive experiences when using digital services in the village library 4. I'm confident in the security and privacy of personal information when using digital services at the village library.	DMIS DOI DMIS DMIS

Table 3.4

Questionnaire Development for User Satisfaction

Operation Definition	Measurement	Source
User Satisfaction		
User Satisfaction	1. I am satisfied with the digital services provided in the rural public library. 2. I am involved in the development and maintenance of rural libraries through the use of digital technology 3. Technological services in rural libraries are accessible to all levels of society. 4. Digital services in rural libraries benefit the learning and progress of the local community	

Table 3.5

Questionnaire Development for Digital Technology Sustainability

Operation Definition	Measurement	Source
Digital Technological Sustainability		
Digital Technological Sustainability	1. I know about the issue of digital sustainability and its impact on rural libraries	
	2. There are various sustainability-oriented activities in the application and use of digital technology in rural libraries	
	3. I am satisfied with sustainability-oriented activities in the application and use of digital technology in rural libraries.	
	4. Services and digital technology in rural libraries are easily accessible to all levels of society	

3.5.3 National Library Expert Approval

The National Library of Malaysia play a major role regarding the management of rural public libraries. Therefore, the development of the instrument also involved and been approved by the National Archive of Malaysia, to make sure that suitable instruments been developed by the researcher. The number of the approval letter on the instrument development is Reference Number: PNM 176 Jld. 40 (12).

3.6 Pre-Test (National Library Expert Approval)

For this study, a pre-test will be conducted to ensure the reliability and validity of the questionnaire before distributing it to the larger sample. The pre-test will involve a smaller, targeted group of respondents to identify any ambiguities, difficulties in understanding, or inconsistencies in the questionnaire. To guarantee the quality of the survey, the questionnaire will be reviewed and receive validity approval from National Library of Malaysia. The involvement of this institution is essential, as it serves as the primary body overseeing public libraries in Malaysia, including rural public libraries (RPLs). By seeking feedback from this authority, the study ensures that the questions align with national standards and are relevant to the context of rural public library services (Rahman et al., 2023).

SELANGOR					
NAMA PD	NAMA PETUGAS	GREED	EMAIL	NO TEL	ZON
PD PARIT 7	FANIZA AKMAL BINTI MUHAHYIDDIN	S 29	pdkbk1b2s29@gmail.com	016 9531983	B1
PD KAMPUNG BUKIT KERAYONG 1	FANIZA AKMAL BINTI MUHAHYIDDIN	S 29	pdkbk1b2s29@gmail.com	016 9531983	B2
PD KG SG KELAMBU	NOR AZIZAH BINTI SABIHIN	S29	penyelia_b3@pnrm.gov.my	012 6375094	B3
PD KG HULU CHUCHOH	NOORHASMAYANI BINTI ALI	S 29	penyelia_b4@gmail.com	013-4480128	B4
PAHANG					
NAMA PD	NAMA PETUGAS	GREED	EMAIL	NO TEL	ZON
PD INDERA MAHKOTA	ZULKIFLI BIN MOHD ALI	S 29	penyelia_c1@pnrm.gov.my	012-9577147	C01
PD TELUK SENTANG	ROSEMAWATI BINTI MOHD ALI	S 29	penyelia_c2@pnrm.gov.my	019-2153627	C02
PD SEBERANG CHENOR	NURUL AFZAN BINTI MOHAMED	S 29	penyelia_c3@pnrm.gov.my	014-5135134	C03
PD KG NEW ZEALAND	ASMA' BINTI NAZERI	S 29	penyelia_c4@pnrm.gov.my	017-7013171	C04
PD KG BUKIT BETONG	MOHD HAFIZUDDIN BIN ABU TALIB	S 29	penyelia_c5@pnrm.gov.my	019-9412806	C05
PD KG PERPAT	ZAIINTAN MUHAIZA BINTI ZAINUDDIN	S 29	penyelia_c8@pnrm.gov.my	011-29302421	C06
PD KG PULAU RUSA	FARIDAH BINTI JUSOH	S 29	penyelia_c7@pnrm.gov.my	011-10623775	C07
PD BATU PAPAN	NURUL AFZAN BINTI MOHAMED	S 29	penyelia_c3@pnrm.gov.my	014-5135134	C08
PD MASJID KG RELONG	FARIDAH BINTI MUSTAFA	S 29	penyelia_c9@pnrm.gov.my	013-2323013	C09
PERAK					
NAMA PD	NAMA PETUGAS	GREED	EMAIL	NO TEL	ZON
PD KG RPT KUAK LUAR	MOHD ROSLI BIN ABDUL RAZAK	S 29	penyelia_a1@pnrm.gov.my	019-5936706	A1
PD SUNGAI BAYOR	MARDHIYAH BINTI MOHD NOR	S 29	penyelia_a2@pnrm.gov.my	019-4728083	A2
PD TAMAN SERI SELINSING	KHAIROL BASHARIAH BINTI SAAYA	S 29	penyelia_a3@pnrm.gov.my	011-40212671	A3
PD KG ULU KUANG	NOOR SINASURIATIE BINTI MUHAMAL	S 29	penyelia_a4@pnrm.gov.my	019-4794303	A4
PD KG TERSUSUN TELUK MEMALI	MOHAMMAD ANUAR BIN HJ MUSTAFA	S 29	penyelia_a5@pnrm.gov.my	012-2446343	A5
PD KG TUALANG SEKAH	NUR FARAH AZWIN BINTI MOHD JAILA	S 29	penyelia_a6@pnrm.gov.my	017-5515778	A6
PD KG DATO SERI KAMARUDDIN	RASHIDAH BINTI JERI	S 29	penyelia_a7@pnrm.gov.my	019-5481796	A7
PD KG TERSUSUN BATU 8	NURUL AINN BINTI ZULIKRAM	S 29	penyelia_a8@pnrm.gov.my	012-2105312	A8
PD KAMPUNG KOTA LAMA KANAN	NORHASRIFAH BINTI MAAKHIR	S 29	penyelia_a9@pnrm.gov.my	019-5043647	A9

Figure 3.4 Lists of personnel given by National Library of Malaysia

During the pre-test phase, the questionnaire will be sent to several key personnel from National Library of Malaysia as well as a select group of librarians and users from various rural public libraries. This group will be asked to assess the clarity of the questions, the relevance to their experiences with digital library services, and the overall structure of the questionnaire. Their feedback will be vital in refining the questions to ensure they accurately measure aspects like technology awareness, technology usage, and sustainability with RPL digital library services. Based on their feedback, any necessary modifications will be made to enhance the instrument's reliability and validity (Jusoh & Abdullah, 2022).

The pre-test will also help confirm the suitability of the Likert scale used for the measurement of variables, including satisfaction with digital technology services. The feedback obtained from this preliminary test will help ensure that the Likert scale accurately captures respondents' perceptions, particularly in the rural context where digital literacy may vary. Following the pre-test, the questionnaire will undergo a final revision before being distributed widely to the study's main sample (Salleh & Sulaiman, 2022). This rigorous process is critical for ensuring that the data collected is both accurate and meaningful, contributing to a comprehensive analysis of digital technology sustainability in rural public libraries.

3.7 Reliability of the Instrument: Pilot Study

Pilot study in survey research has commonly been conducted to test the suitability of the instrument before conducting the actual data collection before using the instrument (Bujang et al, 2024). A pilot study will be conducted as a preliminary phase of the research to ensure that the research instrument, in this case, the questionnaire, functions as intended before the main data collection. The purpose of this pilot study is to identify any potential issues, such as unclear questions, response biases, or other limitations that might affect the accuracy and reliability of the findings.

The pilot study will involve 30 representative respondents from the target population, specifically users of Rural Public Libraries (RPLs) in Malaysia. This is supported by the statement by Bujang et al (2024), that states that the minimum sample size of 30 respondents is sufficient in assessing the reliability of the instrument. These respondents will be carefully selected to represent a range of demographic groups, including different age groups, levels of education, and frequency of digital library usage. The feedback from these participants will be crucial for refining the questionnaire to ensure its effectiveness in the full-scale study (Jusoh & Abdullah, 2022).

Table 3.6 shows the Cronbach's Alpha measurements for the instrument. All other components recorded Cronbach's Alpha values greater than 0.80, indicating high reliability. For Technology Awareness and Usage, Cronbach's Alpha value was 0.899, which is still reliable. Satisfaction had a Cronbach's Alpha of 0.826, while Sustainability recorded values is 0.895, indicating very high reliability.

Table 3.6
Reliability of Instrument Measures Based on Pilot Study

Components	Cronbach's Alpha	Number of Items
Technology Awareness and Usage	0.899	5
Satisfaction	0.826	4
Sustainability	0.895	4

3.8 Data Collection and Analysis Technique

Data collection and analysis techniques required when conducting the research, especially for mixed method research approaches. The data collection that has been gathered by the researcher will be analysis to explore and examine the results based on the selected analysis techniques.

3.8.1 Data Collection

Data collection and analysis techniques required when conducting the research, especially for mixed method research approaches. The data collection that has been gathered by the researcher will be analysis to explore and examine the results based on the selected analysis techniques.

3.8.2 Data Analysis

Data analysis refers to the process of systematically collecting, cleaning, transforming, describing, modeling and interpreting data (Eldridge, 2025). The mixed method research that employs the both qualitative and quantitative research approaches required different kinds of the data analysis techniques. The selection of data analysis techniques has been chosen based on the type of research as well as methodology for that research topic. In this study, the qualitative and quantitative data are not treated with equal weight; rather, the design is exploratory sequential, with quantitative analysis serving as the dominant strand. The qualitative phase contributes by providing contextual understanding and ensuring that the user survey reflects the realities faced by librarians in rural public libraries. Validity of the qualitative findings was ensured through consistency with the literature and cross-verification with multiple librarian perspectives, rather than through triangulation. The quantitative phase, on the other hand, provides the primary basis for statistical testing and hypothesis validation. This structure allows the qualitative phase to function as a supportive foundation while maintaining the quantitative results as the core of the study's interpretation.

Phase 1 (Qualitative Data Analysis) The qualitative phase was analyzed using thematic analysis to identify patterns and meanings within the interview data collected from rural librarians. Following Braun and Clarke's (2006) six-phase framework, the

researcher first familiarized themselves with the transcripts, generated initial codes and then organized these codes into potential themes. These themes are reviewed, refined and named to ensure they accurately represented librarians perspectives on digital technology sustainability, particularly in relation to digital programs, collaboration efforts and community engagement. The purpose of this analysis was to generate contextual insights that would inform and refine the quantitative survey instrument, ensuring that the constructs measured reflected real operational challenges within rural public libraries in Pahang.

Phase 2 (Quantitative Data Analysis) For the quantitative phase, data were analyzed using both SPSS and SmartPLS. SPSS was used to perform descriptive statistics including mean, median and standard deviation to summarize user responses. Inferential analysis was conducted to explore relationships among variables relevant to digital technology sustainability. Structural Equation Modelling (PLS-SEM) using SmartPLS provided a comprehensive approach for testing the hypothesized relationships among awareness, usage satisfaction and sustainability. The analysis followed the standard two- step procedure; (I) evaluation of the measurement model to assess reliability and validity through indicators such as Cronbach's Alpha, Composite Reliability (CR) and the Average Variance Extracted (AVE); and (ii) evaluation of the structural model to test the strength and significance of the proposed relationships.

3.9 Ethical Approval

Ethical considerations encompass obtaining informed consent from all participants, ensuring confidentiality and anonymity, and addressing potential biases. Informed consent involves clearly communicating the purpose, procedures, and potential impacts of the study to participants, allowing them to make an informed decision about their involvement (Creswell & Creswell, 2018). Confidentiality and anonymity are critical to protect participants' identities and personal information, which helps in maintaining trust and adhering to data protection regulations (Beauchamp & Childress, 2019). Additionally, the research must be designed and executed to minimize any biases that could affect the results and interpretations, ensuring the findings are accurate and representative of the population studied (Smith, 2015). These ethical practices ensure that the study contributes valuable insights into the impact of digital

technology on user satisfaction while respecting and protecting the rights of the participants.

Table 3.7
Ethical Considerations for This Research

Ethical Consideration	Explanation
Informed Consent	Participants are provided with comprehensive information about the study's purpose, procedure and potential impacts. They must voluntarily participate, ensuring they understand their involvement. (Creswell, 2018).
Confidentiality	Protecting participants' personal information and ensuring their identities are not disclosed without consent. This practice helps in maintain trust and complying with data protection regulation (Beauchamp & Childress, 2019).
Anonymity	Ensuring participants identities are not linked with their responses, safeguarding their privacy and reducing of personal information identified (Beauchamp & Childress, 2019)
Minimizing Bias	Involves designing the study to avoid any potential bias that could skew the results. This includes diverse representation and employing objective data analysis method (Smith, 2015).

3.9.1 UiTM Approval

In conducting research for the thesis titled " Assessing the State of Pahang Librarian Perspectives and User Satisfaction on Digital Technology Sustainability in The Rural Public Library," adherence to research ethics is paramount to ensure the integrity and credibility of the study. The number of the approval letter on the research ethics approval is Reference Number: REC/12/2023 (PG/MR/473).

3.9.2 National Library Approval

In Malaysia, the rural public libraries have been administered National Library of Malaysia and the government state. According to Abdullah, Omar and Bolong (2013), the rural library has been established in 2000 and during that time the total twenty-five (25) rural library has been established in selected state in Malaysia. Into the data, the total five hundred six (506) of National Library of Malaysia's rural libraries has been introduced for whole Malaysia. In State of Pahang, for example, there is a total

number of 62 rural public library in which consist of twenty-nine (29) rural libraries state and thirty-three (33) National Library of Malaysia's rural libraries. Therefore, the National Library of Malaysia play significant role in assist the researcher to approve this researcher particularly for research ethic approval where this organization is main organization that handling the rural libraries in Malaysia. Therefore, the consent in conducting this research has been approved by the National Archive of Malaysia. The number of the approval letter on the research ethics approval is Reference Number: PNM 176 Jld. 40 (12).

3.10 Summary of Chapter

This chapter provided a detailed account of the research methodology and ethical standards applied in the study. By employing rigorous data analysis techniques and adhering to ethical principles, the research aimed to offer valuable insights into how digital technology affects user satisfaction and sustainability in rural public libraries. The methodology and ethical considerations outlined in this chapter form the foundation for the subsequent analysis and discussion of findings in the following chapters.

CHAPTER 4

DATA ANALYSIS AND FINDINGS

4.1 Introduction

This chapter was discussed on the data analysis and findings of this study. The results from the data analysis and findings will be presented in descriptive and inferential statistics. The descriptive statistic was examining the demographic information of the respondents. The scientific software that has been used to analyze the data gathered from data collection is Statistical Package for Social Science (SPSS) version 29. While the inferential statistics were examined to analyze the relationship between independent variables with dependent variables.

4.2 Demographic Background of Respondents (Librarian and Library User)

The collected and valid response was collected among librarians from rural public libraries and its users. Eight (8) informants among librarians also participated in the interview session with the researcher, while a total of 384 respondents participated in this survey. Therefore, the overall number of participants who participated in this study is 392 respondents or informants. The demographic information was analyzed to examine the background characteristics of the respondents who took part in the survey.

4.2.1 Gender

The table below shows the gender of respondents who participated in this study. The respondents or informants consist of librarians in RPL and users who frequently visited the State Pahang Rural Public Library. The table below shows the number of librarians who participated in this study. Based on table below, there are two (2) males, while six (6) female who participated in this study.

Table 4.1
Gender of Librarians Who Participated in This Study

No	Name	Gender	Position	Organization
1	R1	Male	Assistant Librarian (S29)	Perpustakaan Desa Bandar Indera Mahkota (Zon C 01)
2	R2	Female	Assistant Librarian (S29) / Supervisor Zon	Perpustakaan Desa Kg. Teluk Sentang
3	R3	Female	Assistant Librarian (S29)	Perpustakaan Desa Seberang Chenor
4	R4	Female	Assistant Librarian (S29) / Supervisor Zon 4	Perpustakaan Desa PNM Kg New Zealand
5	R5	Male	Assistant Librarian (S29)	Perpustakaan Desa PNM Kampung Bukit Betong
6	R6	Female	Assistant Librarian (S29)	Perpustakaan Desa Kg Perpat
7	R7	Female	Assistant Librarian (S29)	Perpustakaan Desa Kg Pulau Rusa
8	R8	Female	Assistant Librarian (S29) / Supervisor Zone 9	Perpustakaan Desa Masjid Kg Relong

While the total number library user participated in this survey consist of female respondents was 278 or 72.4% of the entire sample. In contrast, the male respondent contributes was 106 or 27.6% of the whole research sample. Through this survey show that the female respondents were found more participated in this survey than male respondents.

Table 4.2
Gender for Library Users

		Age			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	106	27.6	27.6	27.6
	Female	278	72.4	72.4	100.0
Total		384	100.0	100.0	

4.2.2 Age

Based on the results show that the age of respondents that participated in this survey. As shown in Table 3, majority of respondents between 36 until 45 years old (n = 384, 32.3%), followed by those between 26 until 35 years old (n = 384, 26.3%), then 18 until 25-year-old with (n = 384, 20.8%) and age 46 until 55 years old (n = 384, 15.9%). The least number of respondents are between the age 56 years old and above (n = 384, 4.7%). Based on the data, the respondents who participated in this study were among the adults aged 36 until 45 years old.

Table 4.3
Age of Respondents

		Age			Cumulative Percent
		Frequency	Percent	Valid Percent	
Valid	18 - 25 years old	80	20.8	20.8	20.8
	26 - 35 years old	101	26.3	26.3	47.1
	36 - 45 years old	124	32.3	32.3	79.4
	46 - 55 years old	61	15.9	15.9	95.3
	56 years old and above	18	4.7	4.7	100.0
Total		384	100.0	100.0	

4.3 First Phases: Qualitative Data Analysis

The analysis of qualitative data was discussed in the section. The data from the interview session with eight (8) librarians was conducted. The three (3) themes on digital technologies availability will be assessed by librarians to enhance the user satisfaction on the rural public library services. As follows the indicators for each librarian who participated in this study. Each of the librarian will be assigned as “RPLS” as Rural Public Library Staff and follow by the number of participants.

Table 4.4
Indicators That Indicate the Librarians Who Participated in This Study

No	Name	Organization	Indicator
1.	Zulkifli Bin Mohd Ali	Perpustakaan Desa Bandar Indera Mahkota (Zon C 01)	RPLS 1
2.	Rosemawati Binti Mohd Ali	Perpustakaan Desa Kg. Teluk Sentang	RPLS 2

No	Name	Organization	Indicator
3.	Nurul Afzan Binti Mohamed	Perpustakaan Desa Seberang Chenor	RPLS 3
4.	Asma' Binti Nazeri	Perpustakaan Desa PNM Kg New Zealand	RPLS 4
5.	Mohd Hafizuddin Bin Abu Talib	Perpustakaan Desa PNM Kampung Bukit Betong	RPLS 5
6.	Zaiintan Muhaiza Binti Zainuddin	Perpustakaan Desa Kg Perpat	RPLS 6
7.	Faridah Binti Jusoh	Perpustakaan Desa Kg Pulau Rusa	RPLS 7

ROI : To investigate the current state of digital technology availability and awareness in rural public libraries in Pahang

In the first phases of data collection, qualitative data was analyzed to investigate the current scenario of digital technology availability in enhancing the user satisfaction on the rural public library services. In this qualitative data from interview session with the librarian, there are three main elements that will be assessed which are digital library program, collaboration and partnership as well as community engagement.

Qualitative findings reveal that digital technology is available across all participating rural public libraries in Pahang, but the extent and quality of these technologies vary significantly. A consistent pattern across interviews showed that most libraries provide basic digital facilities such as computers, Wi-Fi access and online reference platforms. However, librarians frequently report that these technologies are limited in number, outdated or affected by inconsistent internet connectivity. This uneven availability suggests that while digital access exists, its reliability and adequacy are not uniform, creating variation in user experience. These findings support earlier studies indicating that technological infrastructure remains a critical determinant of digital service quality in rural settings.

Librarians also highlighted that digital literacy programs—such as ICT workshops, online quizzes, and guided digital learning modules—play a vital role in enhancing user satisfaction. Participants consistently noted that users who attend these programs demonstrate higher confidence in navigating digital resources and show greater willingness to engage with technology-based services. However, challenges such as insufficient staffing, limited training opportunities, and inconsistent program funding hinder the ability of libraries to offer regular and structured digital literacy

sessions. This suggests that although digital programs exist, their sustainability and effectiveness rely heavily on resource availability and librarian capacity.

Importantly, the qualitative findings reveal a clear relationship between digital technology availability and user satisfaction. Libraries with better-maintained computers, stable internet access, and active digital literacy initiatives reported noticeably higher levels of user engagement. In contrast, libraries with outdated equipment or unreliable connectivity received more user complaints and lower program participation. These trends illustrate that availability alone is insufficient; quality, accessibility, and usability of digital technologies significantly shape user satisfaction. This aligns with the IS Success Model, where system quality and service quality directly influence satisfaction and continued use. Thus, RO1 findings demonstrate that improving the availability and reliability of digital technology is critical for enhancing user satisfaction and strengthening long-term digital sustainability in rural public libraries.

4.3.1 Digital Literacy Program

The qualitative findings reveal that digital literacy programs are a central element of rural public library services, designed to enhance user skills and increase engagement with digital resources. A recurring pattern across the interviews shows that libraries offer structured and continuous digital literacy activities such as basic computer training, online search strategies, digital content creation and online safety modules. Tend to experience higher levels of user confidence and satisfaction. These programs not only help users navigate digital tools but also promote responsible and independent technology use, reflecting the broader definition of digital literacy as the ability to evaluate, organize, create and communicate information using digital platforms. Librarians noted that users who attended these sessions were more likely to revisit the library and explore additional digital services, suggesting that digital literacy serves as an important gateway to improved user experience and deeper engagement.

In this study, the researcher wants to analyze the digital literacy program organized by a rural public library in Pahang state. The statement from the librarian states there are various digital literacy programs organized in rural public libraries in Pahang states. In terms of the development of digital technology skills of the user, several activities program to enhance the digital technology of library users within the

rural communities. The findings highlight that all the rural public libraries (RPLS 1, RPLS 2, RPLS 3, RPLS 4, RPLS 5, RPLS 6, RPLS 7 and RPLS 8) have conducted the program known as Sistem Pembelajaran Kendiri Literasi Media dan Maklumat (Sistem e-LMM). Based on the statement of RPLS 1, RPLS RPLS 2, RPLS 3, RPLS 4, RPLS 5 and RPLS 7 state that this RPL has organized the ICT Literacy program such as online quiz. While other programs such as eBusiness Workshop have also been organized by RPLS1, RPLS 3, RPLS 5, RPLS 6 and RPLS 7. The statement of the librarian for each of the rural public library as follows:

“Rural Public Library (RPL) Zon C1 in Pahang organized various programs, workshops, or activities that focus on developing digital technology skills for library users with the aim of increasing access to technology and educating the local community about right and effective use digital technology applications. Some activities have been conducted here, such as eBusiness Workshops, ICT Literacy Activities, Soduku, ICT Test Activities, e-sports and online quizzes.” (mention by RPLS 1)”

“This rural public library also holds programs, workshops, or activities that focus on the development of digital technology skills for users with the aim of increasing access to technology and educating the local community about proper and effective use such as E-LMM (known as Media and Information Literacy Self-Learning System). In addition, virtual activities like Virtual Quiz Program are held every month on our library Facebook Page and publicized to the public for participation purposely to encourage library users with the use of digital technology.” (mention by RPLS 2)

“Rural Public Library Zon 3 at the Maran and Rural Public Library Zon 8 at the Bera also hold programs, workshops, or activities that focus on the development of digital technology skills for users with the aim of increasing access to technology and educating the local community about proper and effective use such as the eBusiness Workshop, Click Wisely Program, Advertising Workshop and AI Module and IT Literacy Activities.” (mentioned by RPLS 3)

“Rural Public Library Zone 4 also holds programs, workshops, or activities that focus on the development of digital technology skills for users with the aim of increasing access to technology and educating the local community about correct and effective use such as ICT Quiz conducted virtually on Facebook RPL Kg New Zealand, Workshop Using ICT physically at RPL Kg

Kuala Sentul, Promotion and u- Library Membership Campaign by Rural Public Library Kg Senggora. (mentioned by RPLS 4)

“Rural Public Library Zon C5, Pahang also holds programs, workshops, or activities that focus on the development of digital technology skills for users with the aim of increasing access to technology and educating the local community about proper and effective use such as eBusiness Workshops, ICT Quizzes, Access to U- Library etc. (mentioned by RPLS 5)

“The Rural Public Library in Zone C6 Pahang also holds programs, workshops, or activities that focus on the development of digital technology skills for users with the aim of increasing access to technology and educating the local community about correct and effective use such as e-Census Briefing, Online Entrepreneur Course, Pahang Zakat Application Briefing via online at RPL Bandar Tun Razak, Shopee Entrepreneur Course at RPL Tg Gemok and IT Quick Workshop at RPL Simpang Sepayang”. (mentioned by RPLS 6)

“Rural Public Library Kg Pulau Rusa also holds programs, workshops, or activities that focus on developing digital technology skills for users with the aim of increasing access to technology and educating the local community about proper and effective use such as the U-Library Campaign and the Kg Product Entrepreneurship Workshop and ICT Quiz at RPL Lamir”. (mentioned by RPLS 7)

“Rural Public Library Zon 9 also holds programs, workshops, or activities that focus on the development of digital technology skills for users with the aim of increasing access to technology and educating the local community about proper and effective use such as the u-Pustaka Workshop”. (mentioned by RPLS 8).

In terms of development of user computer literacy skills, the majority librarian state that the rural public library will ensure that the necessary skill is equipped to the library user regarding the computer literacy program. RPLS 1, RPLS 2, RPLS 3, RPLS 4, RPLS 5, RPLS 6, RPLS 7 and RPLS 8 state that RPL will equip the library user with the computer literacy skills so library user learns and understands about the computer literacy. While RPLS 8 state the activity that organized by Rural Public Library Masjid Kg Relong such as learn about Microsoft Office, Canva and others. As follows the statement by Rural Public Library Staff (RPLS):

“The programs at our library also help to ensure that rural communities have the necessary skills by collaborating with the Rural Internet Center (PID) to implement computer literacy programs”. (mentioned by RPLS 1, RPLS 2, RPLS 3, RPLS 4, RPLS 5, RPLS 6, RPLS 7, RPLS 8)

“The programs at RPL Zone 9, Pahang also help to ensure that rural communities have the necessary skills such as the use of Microsoft Office, Canva and others by collaborating with the Rural Internet Center (PID) and the Malaysian Family Digital Economy Center (PEDi) to implement computer literacy programs”. (Mentioned by RPLS 8)

For internet browsing skills, the RPL organizes a program related to internet browsing skills for the library users, to ensure the user can surf the internet in a safe and good manner. All the librarians which are RPLS 1, RPLS 2, RPLS 3, RPLS 4, RPLS 5, RPLS 6, RPLS 7, and RPLS 8 state that their RPL has organized a program related with internet browsing purposely to improve users' digital literacy. RPLS 5 states that the program related to internet browsing is CLICK wisely. The statement is as follows by all librarians:

“This RPL also organizes a program related to internet browsing to improve users' digital literacy, to ensure they can use the internet in a safe and responsible manner”. (mentioned by RPLS 1, RPLS 2, RPLS 3, RPLS 4, RPLS 5, RPLS 6, RPLS 7, RPLS 8)

“PNM Village Library Zone C5, Pahang also organizes a program on internet browsing to improve users' digital literacy, to ensure they can use the internet in a safe and responsible manner. For example, CLICK wisely”. (Mentioned by RPLS 5).

While, regarding the education about online safety, majority of the rural public library in Pahang state does not organize any program related to online safety to the rural community. However, only librarian or officer in RPL has given exposure regarding the online security. The following statement by RPLS 1, RPLS 2, RPLS 3, RPLS 4, RPLS 5, RPLS 6, RPLS 7 and RPLS 8 mention the same statement in which:

“In terms of consumer education about online safety, no program like that but the librarian and officer only been given exposure and brief on the online safety” (mention by RPLS 1, RPLS 2, RPLS 3, RPLS 4, RPLS 5, RPLS 6, RPLS 7 and RPLS 8).

The findings show that all the librarians (RPLS 1, RPLS 2, RPLS 3, RPLS 4, RPLS 5, RPLS 6, RPLS 7 and RPLS 8) state that various digital literacy programs organized in rural public libraries in Pahang states. Some of the activities related to technology like ICT Literacy activities, online surfing and browsing skills to improve the digital literacy skill of rural communities in Pahang states. Each of RPL may have different activities that have been organized, however, there are also similar activities organized in RPL. Some of the similar activities such as eBusiness workshop, ICT

Literacy related activities and Aktiviti Galakan Membaca (AGM) were organized to increase awareness towards the technology awareness and usage among library users in Pahang state. Based on the findings, it also was discovered that RPLS 1, RPLS 2, RPLS 3, RPLS 4, RPLS 5, RPLS 6, RPLS 7 and RPLS 8 also try to educate the library user on the computer literacy like conducting Microsoft Office and Canva workshop and conducting the program related with skill on browsing the internet wisely such as program CLICK wisely. However, in terms of online safety, all the rural public libraries state that only their officer that received the exposure on online safety but not the community itself. It is important to educate to increase the awareness to rural communities on the risk on using digital technology nowadays.

The findings show that the rural public libraries have already organized a program to educate the library user in developing the digital technology skill. This been supported by the Martzoukou and Elliott (2016) that state public librarian required to additional the library user with the technical skill to promote the digital literacy as well as could understand the need of the community itself. This is significantly important for the library user to equip with the appropriate skill to create a knowledgeable society. These kinds of skills will benefit the rural community to seek the right information on the internet in avoiding misinformation gain on the internet. The effectiveness of digital literacy programs largely depends on their alignment with community needs. Amir et al. (2010) emphasize that ICT training should be tailored to the specific demands of rural populations, as seen in the Komuniti Bridz program, which enhanced digital literacy by integrating practical applications into everyday life. Moreover, the findings

discover that the RPL does not organize programs related to online safety, data privacy and security and cyber- security as awareness to the communities to use the technology in the right ways. It is significantly important to educate the rural communities on the risk of using digital technology wrongly.

4.3.2 Collaboration and Partnership

The qualitative findings indicate that collaboration and partnership play a significant role in strengthening digital service delivery within rural public libraries in Pahang. Through interviews, librarians consistently highlighted that partnerships with government agencies, educational institutions, and local community organizations provide essential support for digital programs, particularly in the areas of training, resource sharing, and outreach. These collaborations increase the visibility of rural libraries and reinforce their role as community information hubs, especially in underserved areas where access to digital learning opportunities is limited. Librarians reported that when external partners assist with workshops, digital literacy campaigns, or technology donations, user engagement increases and community trust in digital initiatives strengthens. This trend suggests that partnerships are not merely supplementary, but a structural mechanism that enhances the capacity of rural libraries to deliver effective and sustainable digital services.

However, the findings also reveal disparities in the availability and strength of such collaborations across RPLs in Pahang. While some libraries benefit from active engagement with local councils, schools, and state agencies, others struggle to secure consistent support due to geographic isolation, limited networking opportunities, or insufficient staffing. These inconsistencies contribute to uneven digital service quality across the state. The qualitative data aligns with findings from UiTM (2024), which showed that partnerships significantly enhance community empowerment and information accessibility in both Malaysian and Australian rural libraries. For Pahang, this implies that expanding inter-agency cooperation, especially with digital training centers, NGOs, and government programs under MyDIGITAL could help address resource gaps, improve digital literacy outcomes, and strengthen long-term sustainability. Overall, collaboration and partnership emerge as critical enablers that can amplify the effectiveness of digital initiatives and elevate user satisfaction in rural public libraries.

The finding shows that all the rural public libraries providing the continuous education through collaborative program to provide learning for communities like “Sistem Pembelajaran Kendiri Literasi Media dan Maklumat (Sistem e-LMM)”. Besides that, others initiative by rural public libraries that collaborate with local government agency is program “Aktiviti Galakan Membaca (AGM)”. The statements are as follows:

“Rural Public Library Pahang collaborates with government and non-government agencies in providing continuous education through collaborative programs to provide learning to the local community, for example through the Sistem Pembelajaran Kendiri Literasi Media dan Maklumat (Sistem e-LMM). Besides that, the rural public libraries also state that the collaboration also includes the program like Aktiviti Galakan Membaca (AGM).” (mentioned by RPLS 1, RPLS 2, RPLS 3, RPLS 4, RPLS 5, RPLS 6, RPLS 7 and RPLS 8)

For the program about the “Sistem Pembelajaran Kendiri Literasi Media dan Maklumat (Sistem e-LMM)”, RPLS 8 mentions that there are several levels that have been divided which are basic, intermediate and advanced level. From this finding show that the rural public libraries can identify the library users that could use digital technology at basic level as well as advance level. Based on the statement of RPLS 8:

“Through this learning system, it is divided into 3 levels which are basic level, intermediate level and also advanced level suitable for various levels of society.”

RPLS 2, RPLS 3, RPLS 4 and RPLS 8 mention the local government agency that they have been collaborate has assist them in organizing the program especially related with any application introduced by the Malaysia Government. Several local government agencies that have been collaborate with rural public libraries in Pahang states are nurseries, schools, Jawatankuasa Pembangunan dan Keselamatan Kampung (JPKK), mosques and surau’s, community association, primary school, secondary school, kindergarten, KEMAS, FELDA, TABIKA, youth association, farmer association, Kawasan Rukun Tetangga (KRT) and other agencies that associated with

the community. The statement by the librarian from RPLS 2, RPLS 3, RPLS 4 and RPLS 8. The statement as follows:

“Rural public library in Zone 2 at Temerloh is heavily involved with agencies with collaboration programs with nurseries, schools, JPKK and nearby mosques or suraus.” (mentioned by RPLS 2).

“The library does a lot of networking and cooperation, including with schools, nurseries, JPKK and Persatuan Penduduk as well as other agencies according to the program carried out.” (mentioned by RPLS 3).

“Among the agencies involved are Primary School, Middle School, Unity Kindergarten, Kemas Kindergarten, Kawasan Rukun Tetangga (KRT), Jawatankuasa Pembangunan dan Keselamatan Kampung (JPKK), KEMAS, Farmers' Association, Women's Association of Small Farmers (PWPK), Village Clinic, Mosque, Women's Association Association (GPW) and Village Youth Association, Felda and agencies close to the Village Library Zone 4 community, Pahang.” (mentioned by RPLS 4).

“RPL Zone 9, Pahang often collaborates with various government and non-government agencies in implementing Reading Encouragement Activities (AGM) programs such as TABIKA, schools, JPKK and any other interested agencies. The cooperation from those parties is very helpful for the implementation of the AGM both in terms of funds and support services.” (mentioned by RPLS 8).

The findings show that all the rural public libraries (based on statement RPLS 1, RPLS 2, RPLS 3, RPLS 4, RPLS 5, RPLS 6, RPLS 7, RPLS 8) have collaboration and partnership with the local government agencies and non-government agencies for the implementation of the program “Sistem Pembelajaran Kendiri Literasi Media dan Maklumat (Sistem e-LMM)” and “Aktivit Galakan Membaca (AGM). RPL 8 also added some information on “Sistem Pembelajaran Kendiri Literasi Media dan Maklumat (Sistem e-LMM)” which consist of basic level, intermediate level and advanced level suitable for various levels of society. Through this collaboration, the RPL and local government agency could promote lifelong learning to the community for rural community development. A knowledgeable society could be created if this collaboration and activity consistently been organized by the RPL and local government agency. While RPLS 2, RPLS 3, RPLS 4 and RPLS 8 also mention the organization

that they already collaborate consist of Jawatankuasa Pembangunan dan Keselamatan Kampung (JPKK), KEMAS, FELDA, TABIKA, Kawasan Rukun Tetangga (KRT) and others organization. This kind of collaboration and partnership with the local government agencies and non-profit organization will significantly be essential to promote the lifelong learning within the rural community in Pahang state. According to Osuchukwu and Edewor (2017), collaboration between libraries and community-based organizations could enhance information delivery and indirectly promote sustainable development within the rural communities.

4.3.3 Community Engagement

The qualitative findings show that community engagement is a core function of rural public libraries in Pahang, with librarians consistently emphasizing their role as community hubs that foster social connection, lifelong learning and digital inclusion. Through interviews, librarians reported that engagement activities such as digital workshops, community reading programs, outreach events and collaborations with local schools. It serves as an important platform for introducing users to digital services and sustaining interest in library programs. These activities help bridge gaps in awareness and reduce hesitation among users who are unfamiliar with technology, thereby strengthening user confidence and satisfaction. However, the level of engagement varies across libraries depending on staff capacity, community, participation and available resources, resulting in uneven outcomes. This pattern aligns with Carroll et al. (2011), who noted that rural libraries contribute not only to information access but also to cultural enrichment and community empowerment. The findings indicate that strong community engagement enhances the visibility of digital initiatives and reinforces the library's role in supporting digital sustainability, while limited engagement restricts user uptake and reduces the long-term impact of digital services.

The findings show that the librarian within the rural public library creates engagement with the community by assisting the library user using government applications such as PADU apps. For an example, Programs like CyL Digital in Spain illustrate how libraries can reduce the digital divide through structured digital literacy training (Cadenaser, 2025). This initiative has successfully expanded technology access in rural areas, emphasizing the need for similar efforts in Malaysia's rural public libraries. The librarian will assist the community on how to be using this application, in

which this application is important because a part of Malaysian Government Initiative that contains profiles of individuals and households covering citizens and permanent residents aged 18 and above in Malaysia. This statement has been mentioned by RPLS1, RPLS4, RPLS 5, RPLS 6 and RPLS 7:

*“In our library, the staff will interact with users, especially regarding information literacy through PADU registration at selected RPLs.”
(statement by RPLS1)*

“Rural Public Library Zone 4 also interacts with users especially in relation to information literacy through PADU registration at selected RPLs, namely RPL Kg Kuala Sentul”. (statement by RPLS 4)

“PNM Village Library Zone C5, Pahang also interacts with users, especially regarding information literacy through PADU registration at selected RPLs.”

“Rural public library oversee by me in the Zone C6 also interacts with users especially in relation to information literacy through PADU registration at selected RPL which is RPL Simpang Sepayang.” (statement by RPLS6)

*“RPL Zone C7 Pahang also interacts with users especially regarding information literacy through PADU registration at selected RPLs.”
(statement by RPLS7).*

While RPLS 2, RPLS3 and RPLS 8 also engage with the community using the new application that was introduced by the government like PADU. However, it is different from other RPLS because RPLS 2, RPLS3 and RPLS 8 collaborated with the local government on how to be using the PADU application. Based on RPLS 2:

“All RPL in Temerloh Zone 2 also interact with users especially regarding information literacy through PADU registration at RPL Tg Kerayong on 25/3/2024, RPL Bintang 26/3/2024, RPL Batu Sawar 27/3/2024 and at RPL Teluk Sentang on 29/3/2024. We also cooperate with local authority District Statistics Department to successfully implement this PADU registration.”

Same with rural public library in area of Chenor. According to RPLS 3:

“RPL Zone 3 and Zone 8 also engage with users especially regarding information literacy through PADU registration at selected PDs. The PADU counter was opened for the first time at the Rural Public Library Sri Buntar in collaboration with the JPKK Sri Buntar on March 14, 2024. In addition, the Rural Public Library Batu Papan was also involved with the PADU registration counter on March 23, 2024. The PADU received great benefits to ensure the community in the form of assistance or protection”.

Staff in Perpustakaan Desa Masjid Relong collaborate with Jerantut District Statistics Department to explain and make sure the community register the PADU apps. Based on RPLS 8:

“Our rural public library also interacts with users, especially in relation to information literacy through PADU registration in selected RPLs such as the RPL Bukit Nikmat Kg, Jerantut in collaboration with the Jerantut District Statistics Department. The program received a very encouraging response throughout the two days the program was held.”

Based on the interview session with the informants or participants shows that all the staff in RPL actively engage with the library user, especially assisting the library user in using one of the applications that recently been introduced by the government agency called PADU. The findings show that RPLS1, RPLS4, RPLS 5, RPLS 6 and RPLS 7 engage with the community and assist them on how to use this application. This application known as PADU significantly important to fulfil by Malaysia citizen because for profiling the citizen in Malaysia as well as to ensure that Malaysia citizen receive benefits in the form of assistance or protection (if eligible) from various citizen-focused government initiatives. While RPLS 2, RPLS 3 and RPLS 8 engage with the local community as well as government agency to make sure this application will fulfill by Malaysian citizen. The findings state that significant collaboration with the community is essential to educate the community in using digital technologies in their daily lives. Welser, Khan and Dickard (2019) stated that the online learning communities and social support could be beneficial to the communities itself because could improve their digital skills among the rural population.

4.4 Second Phases: Quantitative Data Analysis

In the second phase of data analysis, statistic data has been used to measure the result of the study. The Statistical Package for Social Science (SPSS) and SmartPLS has been used to measure descriptive and inferential statistic on quantitative data in this study. The quantitative analysis of the user survey data provided statistical evidence supporting the qualitative findings. The results demonstrated a significant positive relationship between the availability of digital technology and user satisfaction. Specifically, the data confirmed that both technology awareness and technology usage are key factors that influence user satisfaction. Users who were more aware of and frequently used digital resources reported higher levels of satisfaction. Furthermore, the analysis showed that this user satisfaction has a positive and meaningful impact on the sustainability of the rural public libraries. This suggests that when users are satisfied with the digital services provided, they are more likely to continue using and supporting the library, thereby contributing to its long-term viability.

According to quantitative findings, user satisfaction and service quality are positively correlated, and this in turn affects how rural libraries' patrons view digital sustainability. The qualitative interviews, however, give these conclusions more nuance. Long-term sustainability issues were raised by librarians because of tight funds, dilapidated infrastructure, and challenges in ensuring that all users have consistent access to digital resources. These observations provide context for understanding why sustainability is still precarious even though many consumers report high levels of happiness. By combining both viewpoints, the study shows that although patrons may appreciate the services that are currently available, librarians anticipate structural issues that could jeopardize their continued existence. This triangulation highlights how crucial it is to match institutional support, policy frameworks, and user happiness to guarantee long-term digital improvement in RPLs.

4.4.1 Data Preparation and Cleaning

The data preparation refers to the process involved transcribing the qualitative data and data entry of quantitative data into the Statistical Package for Social Science (SPSS), data filtering, rewriting the qualitative data in the right statement and finding any missing response in this study. The data also need to be cleaned to make sure the

qualitative data has properly been transcribing while quantitative data should not have any missing value in the SPSS file. This is significantly important to make sure the analysis process will be significant as well as preserving the reliability and validity of the data in this study.

4.4.2 Common Method Bias

The potential common methods bias also been examined in this study. Common methods bias occurred when both independent and dependent variables were measured within one survey, using the same (i.e., a common) response method (e.g., ordinal scales) (Kock, Berbekova & Assaf, 2021). In exploring the common method bias, it is essential to assess the variance explained by single factor in a factor analysis. Based on Harman single factor test, the result on common method bias, the variance should be significantly less than 50% to avoid any concern on common method bias potential. Based on table below show, the result of variance is less than 50% likely the concern on bias potential in the data that has been collected by researchers.

Table 4.5
Total Variance Explained

Component	Total Variance Explained					
	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.116	47.049	47.049	6.116	47.049	47.049
2	1.063	8.178	55.227			
3	.974	7.493	62.720			
4	.794	6.105	68.824			
5	.665	5.118	73.942			
6	.627	4.823	78.765			
7	.563	4.327	83.092			
8	.517	3.977	87.069			
9	.456	3.510	90.578			
10	.405	3.118	93.697			
11	.370	2.845	96.542			
12	.261	2.006	98.547			
13	.189	1.453	100.000			

Extraction Method: Principal Component Analysis

4.4.3 Response Rate (Library User 42 Respondents for Each Zone)

The researcher received the response from the 8 librarians, in which one of the librarians manages two (2) rural public libraries in Pahang. So, the response rate for the interview session with the librarian is 100%. Each of the librarians recommended forty (42) library users who frequently visit the rural public library for distribution of the questionnaire. The selection of the library user is based on the criteria that the library user frequently visits the rural public library as well as participate in activities and program conducted by that rural public library. The table below shows the details of librarian as well as number of library users recommended by librarian itself.

Table 4.6
Number of Librarians and Users

No	Rural Public Library	Librarian	Library User
1.	Perpustakaan Desa Bandar Indera Mahkota (Zon C 01)	1	48 users
2.	Perpustakaan Desa Kg. Teluk Sentang	1	48 users
3.	Perpustakaan Desa Seberang Chenor	1	48 users
4.	Perpustakaan Desa PNM Kg New Zealand	1	48 users
5.	Perpustakaan Desa PNM Kampung Bukit Betong	1	48 users
6	Perpustakaan Desa Kg Perpat	1	48 users
7	Perpustakaan Desa Kg Pulau Rusa	1	48 users
8	Perpustakaan Desa Masjid Kg Relong	1	48 users
Total		8 Librarians	384 of Library users

4.4.4 Descriptive Analysis

According to Hayes (2024), the descriptive statistic refers to the brief information on the coefficients that summarize the datasets that could represent the overall population in the study. Descriptive analysis has been conducted in this study for each of the variables to identify the mean, standard deviation, as well as variance.

4.4.4.1 *Technology Awareness and Usage*

The descriptive analysis has been conducted to analysis the mean, standard deviation, minimum value and maximum value by using the statistical software SPSS version 29.0. The dimensions of technology awareness and usage are knowledge of Digital Technology in Rural Libraries, internet accessibility, digital resources in RPL, positive experience when using digital services as well as confidence in the security and privacy of personal information when using digital services. The number of 5 items represents in this variable in measuring the technology awareness and usage in rural public libraries. Further discussion on the descriptive analysis on this variable was discussed.

Table 4.7
Overall Result of Mean for Technology Awareness and Usage

Descriptive Statistics							
	N	Range	Minimum	Maximum	Mean	Std. Deviation	Variance
TAUmean	384	1.00	4.00	5.00	4.5292	.35780	.128
Valid N (listwise)	384						

As shown in Table, the average score for means of all items is 4.52. Based on statistic data in Table show the highest mean score for the item that states, “I Know about Integrated Digital Technology in Rural Libraries” and “I am Confident in The Security and Privacy of Personal Information when using Digital Services at the Village Library” with average mean score is 4.56 (n = 384). The least mean score for the item that states, “Digital resources in the village library are the main reason why I go to the village library” with mean score is 4.47 (n = 384).

Table 4.8
Result of Mean for Technology Awareness and Usage

Descriptive Statistics								
	N	Range	Minimum	Maximum	Mean	Std. Deviation	Variance	
TAU1 - I Know about Integrated Digital Technology in Rural Libraries/ <i>Saya tahu tentang teknologi digital yang berintegrasi di dalam perpustakaan desa.</i>	384	1	4	5	4.56	.497	.247	
TAU2 - Internet access speed is the main reason why I go to the village library/ <i>Kelajuan akses internet merupakan sebab utama kenapa saya ke perpustakaan desa.</i>	384	1	4	5	4.53	.500	.250	
TAU3 - Digital resources in the village library are the main reason why I go to the village library/ <i>Sumber digital di perpustakaan desa merupakan sebab utama kenapa saya ke perpustakaan desa.</i>	384	1	4	5	4.47	.500	.250	
TAU4 - I had a Positive Experience When Using Digital Services in the Village Library/ <i>Saya memiliki pengalaman yang</i>	384	1	4	5	4.53	.500	.250	
TAU5 - I am Confident in The Security and Privacy of Personal Information when using Digital Services at the Village Library/ <i>Saya yakin dengan keselamatan dan privasi maklumat peribadi semasa menggunakan perkhidmatan digital di perpustakaan desa.</i>	384	1	4	5	4.56	.497	.247	
Valid N (listwise)	384							

4.4.4.2 User Satisfaction

In terms of user satisfaction, there are 4 items that will be measured in this study. The dimension for user satisfaction is satisfaction with digital services, involvement in the development and maintenance of rural libraries, accessibility of technological services and digital services in rural libraries benefit the learning and progress of the local community.

Table 4.9
Overall Result of Mean for User Satisfaction

Descriptive Statistics							
	N	Range	Minimum	Maximum	Mean	Std. Deviation	Variance
SatisfactionMean	384	1.00	4.00	5.00	4.5208	.36116	.130
Valid N (listwise)	384						

As shown in Table, the average score for means of all items is 4.52. Based on statistic data in Table show the highest mean score for the item that states “Digital services in rural libraries benefit the learning and progress of the local community” with average mean score is 4.60 (n = 384). The least mean score for the item that states, “I am involved in the development and maintenance of rural libraries through the use of digital technology” with mean score is 4.38 (n = 384).

Table 4.10
Result of Mean for User Satisfaction

Descriptive Statistics								
	N	Range	Minimum	Maximum	Mean	Std. Deviation	Variance	
Sat1 - I am satisfied with the digital services provided in the rural public library/ <i>Saya berpuas hati dengan perkhidmatan digital yang disediakan di perpustakaan desa.</i>	384	1	4	5	4.57	.496	.246	
Sat2 - I am involved in the development and maintenance of rural libraries through the use of digital technology/ <i>Saya terlibat dalam pembangunan dan penyelenggaraan perpustakaan desa melalui penggunaan teknologi digital.</i>	384	1	4	5	4.38	.485	.235	
Sat3 - Technological services in rural libraries are accessible to all levels of society/ <i>Perkhidmatan Teknologi di perpustakaan desa diakses oleh semua lapisan masyarakat.</i>	384	1	4	5	4.54	.499	.249	
Sat4 - Digital services in rural libraries benefit the learning and progress of the local	384	1	4	5	4.60	.491	.241	

Descriptive Statistics								
	N	Range	Minimum	Maximum	Mean	Std.	Deviation	Variance
community/ <i>Perkhidmatan digital di perpustakaan desa memberi manfaat kepada pembelajaran dan kemajuan masyarakat setempat.</i>								
Valid N (listwise)	384							

4.4.4.3 Digital Technology Sustainability

In terms of digital technology sustainability, there are four (4) main items that have been measured in this study. The dimensions of this variable are the issue of digital sustainability and its impact, various sustainability-oriented activities, Satisfied with Sustainability-Oriented Activities and Services and Digital Technology in Rural Libraries are Easily Accessible.

Table 4.11
Overall Result of Mean for Digital Technology Sustainability

Descriptive Statistics							
	N	Range	Minimum	Maximum	Mean	Std. Deviation	Variance
SustainabilityMean	384	1.00	4.00	5.00	4.5169	.43287	.187
Valid N (listwise)	384						

As shown in Table, the average score for means of all items is 4.51. Based on statistic data in Table show the highest mean score for the item that states “Services and Digital Technology in Rural Libraries are Easily Accessible to all Levels of Society” with average mean score is 4.60 (n = 384). The least mean score for the item that states, “I know about the issue of digital sustainability and its impact on rural libraries” with mean score is 4.44 (n = 384).

Table 4.12
Result of Mean for Digital Technology Sustainability

Descriptive Statistics							
	N	Range	Minimum	Maximum	Mean	Std. Deviation	Variance
Sus1 - I know about the issue of digital sustainability and its impact on rural libraries/ <i>Saya tahu tentang isu kelestarian digital dan impaknya terhadap perpustakaan desa.</i>	384	1	4	5	4.44	.497	.247
Sus2 - There are various sustainability-oriented activities in the application and use of digital technology in rural libraries/ <i>Terdapat pelbagai aktiviti berorientasikan kelestarian dalam</i>	384	1	4	5	4.49	.500	.250
Sus3 - I am Satisfied with Sustainability-Oriented Activities in the Application and Use of Digital Technology in Rural Libraries/ <i>Saya berpuas hati dengan aktiviti berorientasikan kelestarian dalam aplikasi dan penggunaan teknologi digital di perpustakaan</i>	384	1	4	5	4.54	.499	.249
Sus4 - Services and Digital Technology in Rural Libraries are Easily Accessible to all Levels of Society/ <i>Perkhidmatan dan teknologi digital di perpustakaan desa mudah diakses oleh semua lapisan masyarakat</i>	384	1	4	5	4.60	.491	.241
Valid N (listwise)	384						

4.4.5 Result of PLS Measurement: Inferential Statistic

In assessing the relationship between independent variables and dependent variables of the structural model relationship, significant result of path coefficients has been examined. In these stages, it is important to analyse significant structural model path coefficients to examine the relationship between technology awareness and usage influence the rural public library digital technology sustainability as well as role of mediating role of user satisfaction towards rural public libraries sustainability.

4.4.5.1 *Direct Effects (RO2: To Examine the Influence of Technology Awareness and Usage on Rural Public Library Digital Technology Sustainability)*

This data analysis would like to examine the relationship between Technology Awareness and Usage and Rural Public Library Digital Technology Sustainability. Table 4.14 shows the result or findings between this relationship. The result of the direct effects conducted to indicate that Technology Awareness and Usage (TAnU) on RPL Digital Technology Sustainability has significant direct effects on the relationship.

Table 4.13
Direct Effect Between Technology Awareness and Usage with Rural Public Library Digital Technology Sustainability

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values
TAnU -> RPL_DTS	0.359	0.355	0.063	5.738	0.000
TAnU -> US	0.706	0.706	0.031	22.586	0.000
US -> RPL_DTS	0.424	0.428	0.062	6.835	0.000

Based on the above findings has highlight that the Technology Awareness and Usage (TAnU) show the significant direct impact on the RPL Digital Technology Sustainability (RPL_DTS). As show from the path coefficient ($\beta = 0.359$), t-value is 5.738 which show greater than the critical value of 1.96 at the 0.05 significance level while p-value (0.000) that show highly significant has confirm that there is positive relationship between the Technology Awareness and Usage (TAnU) and Rural Public Library Digital Technology Sustainability (RPL_DTS). From the data analysis and findings can highlights that the increased awareness and usage of digital technology within the rural public library will directly contribute towards the sustainability of digital technology initiatives within the rural public libraries particularly in Pahang state. The findings show that it is significantly important to educate the library user for the technology awareness program and ensure that the library user could actively use the digital technology to enhance sustainability of digital services in rural public library in Pahang state.

Moreover, the result also show that technology and awareness significantly will influence the user satisfaction with path coefficients is $\beta = 0.706$, t-value = 22.586 while p-value (0.000) that show highly significant which indicate that the higher technology awareness and usage will lead to the increase user satisfaction among library users on the digital library services. Besides that, the user satisfaction also reveals the positive effect on the RPL Digital Technology Sustainability with the path coefficient is $\beta = 0.424$, t-value = 6.835 while p-value (0.000) that shows highly significant on this relationship. Based on this data analysis that could been seen that if the user satisfies with the digital library services, it will likely that the library user will continuously engage and support digital library services towards sustainability of rural public library in Pahang state. This result will directly contribute towards the long-term sustainability of rural libraries in the Pahang state.

The positive relationship between Technology Awareness and Usage, User satisfaction and digital technology sustainability required the librarian to continuously implement the initiatives like digital literacy program and collaboration and partnership with other agency to continuous engage with the library users. Other than that, the technological infrastructure that has been embedded in the rural public library services should be improved to enhance rural public library services especially on digital technology adoption and sustainable use of the services. This is essential to improve the technological infrastructure to make sure the library user will be satisfied with the library service and directly could sustain and role of the rural public library in the future.

4.4.5.2 Specific Indirect Effect (Mediation) (RO3: To Examine the Mediating Role of User Satisfaction on Technology Awareness and Usage Towards Rural Public Library Digital Technology Sustainability)

The result of the special indirect effects conducted to understand the significant occur on the mediation effect of User Satisfaction (US) on the relationship between Technology Awareness and Usage (TAnU) and RPL Digital Technology Sustainability (RPL_DTS). Table 4.14 shows the result on the special Indirect Effect on the role of user satisfaction as mediating with technology awareness and usage towards rural public library digital technology sustainability.

Table 4.14

Special Indirect Effect on the Role of User Satisfaction as Mediating with Technology Awareness and Usage Towards Rural Public Library Digital Technology Sustainability

	Original	Sample	Standard Deviation	T Statistics	P
	Sample (O)	Mean (M)	(STDEV)	(O/STDEV)	Values
TAnU -> US -> RPL_DTS	0.3	0.302	0.047	6.369	0.000

Based on the result show the path coefficient (β): 0.300, while t-Value: 6.369 (which is greater than 1.96) and p-Value: 0.000 which highly significant indicate that this mediating variable is strong. It explicitly shows and indicates the mediation effect of User Satisfaction (US) on the relationship between Technology Awareness and Usage (TAnU) and RPL Digital Technology Sustainability (RPL_DTS) is significant. From this result show that Technology Awareness and Usage not only significantly direct impact to digital technology in rural public libraries but it also shows the indirect relationship with user satisfaction. It is emphasized that if library users are aware of and use digital technology in rural public libraries, the satisfaction towards the RPL also increases.

This result will indirectly show that user satisfaction plays also important role in making sure the rural public library sustainability in the long term. This finding also shows that user satisfaction is also a key factor that could contribute towards digital technology sustainability in the rural public library in Pahang state. These findings show that awareness on the usage of digital technology is not enough, so it required the user satisfaction on the digital services could enhance the rural public library sustainability. Based on this finding, libraries should improve their digital experience and engagement strategies in strengthening the library's user satisfaction. This is significantly important for the long-term sustainability of the libraries themselves.

4.4.5.3 *Total Effects*

Table 4.16 shows the overall total effect of each of the variables. The variable that was assessed are the technology awareness and usage, user satisfaction and rural public library digital technology sustainability. Based on the table below show the combined direct and indirect effects of technology awareness and usage influence the rural public library digital technology sustainability are strong and significant with path

coefficient (β): 0.659, t-value = 19.575 which it is above the critical threshold of 1.96 for significance at 0.05 level and p-value (0.000, highly significant) indicate that the technology awareness and usage show the crucial role to sustaining the digital technology in rural public libraries. This finding also not only technology awareness and usage directly towards the RPL digital technology sustainability, but it also shows the indirect relationship through user satisfaction. Higher engagement with the digital library services will build engagement with the library user in Pahang state.

Table 4.15

Combined Direct and Indirect Effects of Technology Awareness and Usage Influence the Rural Public Library Digital Technology Sustainability

	Original	Sample	Standard Deviation	T Statistics	P
	Sample (O)	Mean (M)	(STDEV)	(O/STDEV)	Values
TAnU -> RPL_DTS	0.659	0.657	0.034	19.575	0.000
TAnU -> US	0.706	0.706	0.031	22.586	0.000
US -> RPL_DTS	0.424	0.428	0.062	6.835	0.000

Besides that, the result also shows the importance of the user satisfaction as mediating variable in this study. The findings show technology awareness and usage strongly influence the user satisfaction with path coefficients (β): 0.706, t-value = 22.586 and p-value = 0.000. While user satisfaction gives positive impact towards the rural public library sustainability with path coefficients (β):0.424, t-value = 6.835 and p-value = 0.000. From the data reveals that the satisfied user with the library services will continue using and support the rural public library services and indirectly could enhance RPL sustainability for future libraries. From this finding, the library should improve the user experience in using digital technology by organizing the interactive program for the library users. Even though, there are various technologies related programs like RPLS 1 state that programs like Sudoku, Quizzes, AI Module, the librarian should continuously organize this kind program for RPL sustainability in the future.

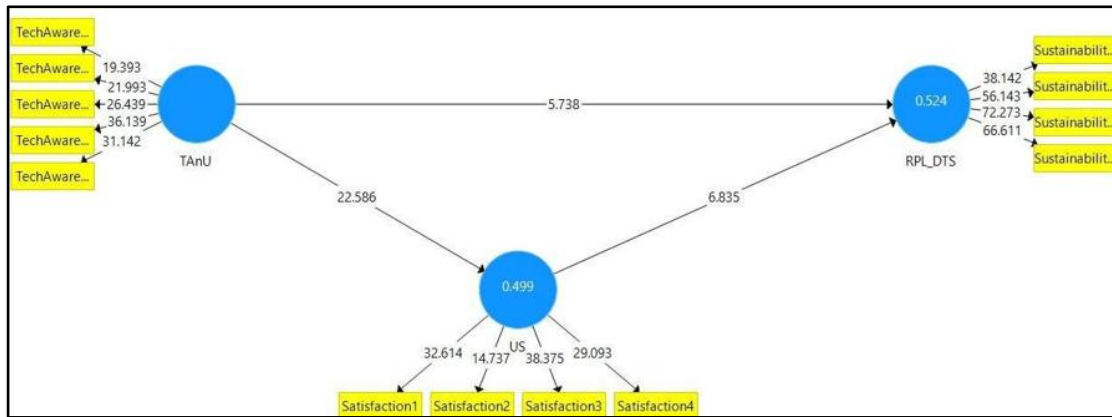


Figure 4.1 Bootstrapping Path Model to Show the Relationship Between the Variables

4.4.6 Normality Test Results

Before conducting ANOVA and SEM analysis, the data were tested for normality. Skewness and kurtosis values were examined for all main variables (Awareness and Usage, User Satisfaction, and Digital Sustainability). As shown in Table X, the skewness and kurtosis values for each construct fall within the acceptable range of ± 2 , indicating that the data distribution is approximately normal (George & Mallery, 2010). This confirms that the assumptions for ANOVA and regression analysis were met.

Variable	N	Mean	Std. Deviation	Skewness	Kurtosis	Result
Technology Awareness & Usage	384	4.52	0.36	within ± 2	within ± 2	Normal
User Satisfaction	384	4.52	0.36	within ± 2	within ± 2	Normal
Digital Sustainability	384	4.52	0.43	within ± 2	within ± 2	Normal

The results show that the dataset meets the assumption of normality and is therefore suitable for further inferential analysis using ANOVA and SEM.

4.4.7 Hypothesis Testing

Hypothesis testing refers to the statistical inferential that uses the data to generate the conclusion about the population's parameter (Williams and Sweeney, 2025).

4.4.7.1 H1: There Is a Significant Relationship Between Technology Awareness and Usage and Rural Public Library Digital Sustainability

The analysis reveals a significant path coefficient ($\beta = 0.359$, $p < 0.05$), indicating that increasing awareness and usage of digital technologies positively contributes to the sustainability of digital initiatives in rural public libraries. The increase the technology awareness and usage will increase the chance and opportunity for the rural public libraries' sustainability. These findings suggest that rural library users are generally well-informed about the presence and role of digital technologies. This finding suggested enhancing and improving the digital literacy program that beneficial to the rural community who frequently visit the RPL. The technological infrastructure, digital tools and accessibility on digital resources should be increased for the long-term sustainability on the role of rural public libraries particularly in Pahang states. Increased technology awareness positively impacts the sustainability of digital services in public libraries. A study on digital capabilities in Malaysian rural communities (HRMARS, 2024) found that higher digital awareness leads to greater utilization of digital resources, thereby improving service longevity.

4.4.7.2 H2: User Satisfaction Has a Mediating Role Towards Rural Public Library Digital Sustainability

Based on the hypothesis, user satisfaction mediates the relationship between Technology Awareness and Usage and RPL Digital Technology Sustainability. In mediation analysis, "Preacher and Hayes Bootstrapping Method" has been applied. Based on the results show and confirm that user satisfaction significantly mediates with technology awareness and usage with rural public library digital technology sustainability. Based on the result, technology awareness and usage is insufficient to support the sustainability of rural public libraries. Therefore, it is necessary to satisfy the users' needs to increase digital technology sustainability in rural public libraries. As follows show the result of testing the hypothesis:

- a) Indirect Effect: The indirect path ($TAnU \rightarrow US \rightarrow RPL_DTS$) is significant ($\beta = 0.300$, $p < 0.05$), confirming that User Satisfaction partially mediates the relationship between TAnU and RPL_DTS.

- b) Direct Effect with Mediator: The direct path (TAnU $\rightarrow$ RPL_DTS) remains significant ($\beta = 0.359$, $p < 0.05$) when the mediator (US) is included in the model, indicating partial mediation.

The findings suggested that although technology awareness and usage immediately support digital sustainability, the relationship will be strengthened with the user experience and satisfaction was guaranteed. According to Yunus and Ismail (2024), smart libraries, integrated technologies and services could enhance sustainability in public libraries. It is important to integrate the technologies with the library services so that it can attract the users to come to the library. Meta-universe technology integration with the library services could increase the user satisfaction and their willingness to interact with the technologies, but it is also necessary to highlight on the data privacy for effective system (Wang and Gao, 2024). From the hypothesis testing, all variables are positive significantly with each other's that show the relationship exist for all variables. User satisfaction serves as a key mediator in library sustainability. Findings from the "Libraries for Health" initiative in the U.S. (AP News, 2024) demonstrate that when users perceive library services as valuable and beneficial, their continued engagement strengthens the long-term viability of digital programs.

4.5 Summary of Chapter

As conclusion, this chapter analysis two (2) phases of data collection based on the objective of this study. The data analysis involved qualitative and quantitative data analysis to assess the component or activities within the RPL could support the digital technology sustainability in the library. It concluded that there are various kinds of programs and activities related to digital technology such as Artificial Intelligence Module, quizzes related test, advertising workshop and others. The program that has already been organized that is related to digital technology will enhance the sustainability component in rural public libraries particularly in Pahang state. In the library user perspective, the overall findings show that the technology awareness and usage directly influenced the digital technology sustainability in rural public libraries. While user satisfaction plays a significant role for the positive impact towards the digital technology sustainability for the RPL. Therefore, it is necessary to improve the existing program and begin to embrace more advanced technology in rural public libraries.

In conclusion, the findings for Research Objective 1 demonstrate that having access to digital technology is a prerequisite for attaining sustainability and user satisfaction, but it is not a sufficient one. The results of the study's qualitative and quantitative stages come together to demonstrate a distinct chain of influence: the availability of digital technology that is well-supported raises user awareness and utilization, which raises user satisfaction. The long-term viability and continued relevance of rural public libraries in the digital era are significantly influenced by this increased level of satisfaction.

CHAPTER 5

CONCLUSION

5.1 Introduction

This chapter discusses the findings presented in Chapter 4 in relation to the research objectives and the existing literature. The study, titled *Assessing the State of Pahang Librarian Perspectives and User Satisfaction on Digital Technology Sustainability in the Rural Public Library*, aims to explore the availability, awareness, and sustainability of digital technology in rural public libraries in Pahang. This discussion interprets the results, identifies key insights, and examines their implications for digital technology sustainability. By evaluating the role of digital infrastructure, user engagement, and librarian perspectives, this chapter provides a critical analysis of how these factors influence the long-term viability of digital services in rural public libraries.

5.2 Discussion of the Themes: Qualitative Research

5.2.1 Digital Literacy

The qualitative findings from Chapter 4 emphasize that digital literacy programs are crucial for improving user engagement and satisfaction. Various initiatives, including the Sistem e-LMM, ICT literacy quizzes, and digital workshops, have been implemented to equip users with the necessary skills to navigate digital resources. These programs have significantly enhanced user confidence and participation, reinforcing findings from prior research (Tripathi et al., 2023). However, challenges such as inconsistent training modules and limited funding remain key barriers to effective digital literacy adoption.

The study also highlights the role of external collaborations in strengthening digital literacy efforts. Partnerships with the Digital Economy Center (PEDi) and other governmental initiatives have contributed to the expansion of training opportunities. Despite these advances, qualitative data indicate that users from underserved communities still experience difficulty adapting to digital services due to a lack of

structured learning programs. Future efforts should focus on standardized training approaches and increased financial support for library-based digital literacy programs.

5.2.2 Collaboration and Partnership

The findings from Chapter 4 demonstrate that collaboration between rural public libraries and external stakeholders is essential for the sustainability of digital services. Partnerships with agencies such as Jawatankuasa Pembangunan dan Keselamatan Kampung (JPKK) and non-governmental organizations have facilitated access to funding, infrastructure, and digital training programs. These collaborations have improved the accessibility and quality of digital library services, aligning with research by Luccy et al. (2024), which highlights the impact of strategic partnerships on rural digital inclusion.

However, the study also reveals disparities in partnership opportunities across different rural libraries. While some libraries have successfully leveraged collaborations to expand their digital offerings, others face challenges in securing long-term partnerships. Addressing these inconsistencies requires policy interventions that promote equitable resource distribution and foster stronger networks between libraries and digital service providers.

5.2.3 Community Engagement

Community engagement emerged as a critical factor influencing the sustainability of digital technology in rural public libraries. As discussed in Chapter 4, libraries act as digital support hubs where users seek guidance on navigating online government services, such as the PADU system. This aligns with findings by Welser et al. (2019), which emphasize the role of libraries in bridging digital literacy gaps within rural communities.

Despite the success of community-driven initiatives, the study found that digital exclusion remains a challenge, particularly among older users. Some respondents expressed hesitation in utilizing digital services due to a lack of familiarity with online platforms. Expanding targeted outreach programs and integrating more user-friendly digital resources can enhance engagement and increase digital literacy levels within rural communities.

5.3 Discussion of the Themes: Quantitative Research

5.3.1 Technology Awareness and Usage

Statistical analysis in Chapter 4 reveals a strong correlation between technology awareness and digital sustainability. Survey findings indicate that while most respondents are aware of digital services in rural libraries, actual usage rates vary. Regression analysis confirms a significant positive relationship between technology awareness and sustainability ($p < 0.05$), reinforcing the importance of proactive digital literacy initiatives (HRMARS, 2024).

Additionally, the data suggest that structured training programs positively influence technology adoption rates. Libraries that implemented interactive learning sessions and digital orientation programs recorded higher user participation levels than those without structured engagement strategies. Future policies should emphasize hands-on digital training to maximize awareness-to-usage conversion.

5.3.2 User Satisfaction

The study establishes that user satisfaction is a key determinant of digital service sustainability in rural libraries. Path analysis results presented in Chapter 4 indicate that satisfaction significantly mediates the relationship between technology awareness and sustainability ($\beta = 0.300$, $p < 0.05$). This finding aligns with AP News (2024), which asserts that higher satisfaction levels drive continuous digital engagement.

Key factors contributing to user satisfaction include digital resource accessibility, internet quality, and librarian assistance. Respondents who received personalized support reported higher satisfaction levels, suggesting that libraries should prioritize technical assistance programs and enhance service delivery mechanisms.

5.3.3 Rural Public Library Sustainability

The study highlights three primary drivers of digital sustainability: technology awareness, user satisfaction, and infrastructure investment. Findings indicate that respondents emphasized the need for improved broadband access, modernized hardware, and continuous librarian training as essential components of sustainable

library services. Yunus & Ismail (2024) suggest that integrated digital solutions, including AI-assisted information retrieval systems, could further enhance service efficiency in public libraries.

Budget constraints remain a significant barrier to sustainability, with some libraries struggling to maintain their digital services due to inconsistent funding. Policymakers should explore alternative funding strategies, such as corporate sponsorships and public-private partnerships, to ensure long-term sustainability.

5.4 Discussion Based on Hypotheses

H1 : Awareness of digital services has a significant positive effect on the sustainability of digital technology in rural public libraries.

The findings support this hypothesis, as statistical analysis revealed a positive correlation between technology awareness and library sustainability. Respondents who were more aware of digital services demonstrated higher engagement and reliance on library resources. This aligns with prior studies emphasizing the role of digital literacy in enhancing sustainability.

H2 : User satisfaction mediates the relationship between awareness, usage, and the sustainability of digital services in rural public libraries.

The data confirms this hypothesis, showing that higher user satisfaction leads to increased sustainability. Libraries with better digital access, quality internet, and supportive staff recorded higher satisfaction levels, which in turn contributed to continued digital service usage and library sustainability.

5.5 Mapping the Results Based on Hypotheses

5.5.1 To Investigate the Current State of Digital Technology Availability to Enhance the User Satisfaction Towards Rural Public Library Sustainability

The findings from Chapter 4 reveal that while digital technology is increasingly available in rural public libraries, disparities exist in infrastructure and internet accessibility. Libraries equipped with well-maintained digital resources and consistent internet services report higher user satisfaction. Quantitative results showed a positive correlation between digital availability and user engagement ($p < 0.05$), emphasizing the importance of stable digital infrastructure. However, qualitative insights highlighted challenges such as outdated hardware and insufficient funding.

Addressing these issues through targeted investments and technological upgrades is crucial for sustaining library services and improving user experience. Libraries that implement structured digital training programs and maintain up-to-date resources tend to see a higher retention rate among users. Strengthening partnerships with government agencies and private sector organizations can provide additional funding and technical expertise, ensuring that digital services remain accessible and efficient for rural communities.

5.5.2 To Examine Technology Awareness and Usage Influence the Rural Public Library Digital Technology Sustainability.

Chapter 4 findings indicate that technology awareness among library users is relatively high, but actual usage remains inconsistent. While survey respondents demonstrated familiarity with available digital services, usage rates varied due to digital literacy gaps and accessibility constraints. Statistical analysis confirmed that technology awareness significantly impacts sustainability ($\beta = 0.310, p < 0.05$), reinforcing the need for structured training programs. Qualitative data further revealed that users in libraries with active digital literacy initiatives reported higher engagement levels. To ensure sustainability, libraries should implement comprehensive awareness campaigns and hands-on training sessions to bridge the gap between awareness and effective technology usage. Furthermore, continuous monitoring and evaluation of technology

adoption trends can help libraries tailor their digital services to meet the evolving needs of rural communities.

Another crucial aspect is the role of librarians in promoting technology usage. Findings from Chapter 4 suggest that libraries where librarians actively assist users in navigating digital resources tend to report higher adoption rates. This indicates that equipping librarians with adequate training and digital competencies can further enhance the effectiveness of technology-driven services. Chapter 4 findings indicate that technology awareness among library users is relatively high, but actual usage remains inconsistent. While survey respondents demonstrated familiarity with available digital services, usage rates varied due to digital literacy gaps and accessibility constraints. Statistical analysis confirmed that technology awareness significantly impacts sustainability ($\beta = 0.310$, $p < 0.05$), reinforcing the need for structured training programs.

Qualitative data further revealed that users in libraries with active digital literacy initiatives reported higher engagement levels. To ensure sustainability, libraries should implement comprehensive awareness campaigns and hands-on training sessions to bridge the gap between awareness and effective technology usage. Furthermore, continuous monitoring and evaluation of technology adoption trends can help libraries tailor their digital services to meet the evolving needs of rural communities.

5.5.3 To Examine the Mediating Role of User Satisfaction Towards Rural Public Library Digital Technology Sustainability.

The results from Chapter 4 highlight user satisfaction as a critical mediator in the relationship between digital service availability and sustainability. Path analysis indicated that higher satisfaction levels led to increased retention and continued use of digital library services. Factors influencing satisfaction include service accessibility, digital literacy support, and librarian assistance. Libraries that provided user-friendly digital interfaces and responsive support recorded significantly higher sustainability scores. These findings suggest that improving service quality and personalizing user experiences are essential for ensuring long-term digital sustainability in rural public libraries. Enhancing user feedback mechanisms and incorporating emerging technologies such as artificial intelligence in digital library services could further optimize user satisfaction and service effectiveness.

Moreover, the study emphasizes the importance of community-driven digital literacy programs in boosting satisfaction. Libraries that engaged in active community outreach, workshops, and interactive sessions had users who expressed higher confidence in using digital services. Future initiatives should integrate localized approaches to digital literacy, ensuring that training programs align with the specific needs of rural communities.

The results from Chapter 4 highlight user satisfaction as a critical mediator in the relationship between digital service availability and sustainability. Path analysis indicated that higher satisfaction levels led to increased retention and continued use of digital library services. Factors influencing satisfaction include service accessibility, digital literacy support, and librarian assistance. Libraries that provided user-friendly digital interfaces and responsive support recorded significantly higher sustainability scores. These findings suggest that improving service quality and personalizing user experiences are essential for ensuring long-term digital sustainability in rural public libraries. Enhancing user feedback mechanisms and incorporating emerging technologies such as artificial intelligence in digital library services could further optimize user satisfaction and service effectiveness.

The findings from Chapter 4 reveal that while digital technology is increasingly available in rural public libraries, disparities exist in infrastructure and internet accessibility. Libraries equipped with well-maintained digital resources and consistent internet services report higher user satisfaction. Quantitative results showed a positive correlation between digital availability and user engagement ($p < 0.05$), emphasizing the importance of stable digital infrastructure. However, qualitative insights highlighted challenges such as outdated hardware and insufficient funding. Addressing these issues through targeted investments and technological upgrades is crucial for sustaining library services and improving user experience.

5.6 Recommendations

Several suggestions are made to improve the sustainability of digital technology in rural public libraries (RPLs) in light of the study's findings. These suggestions tackle the difficulties noted in the quantitative and qualitative stages, especially those related to librarians' awareness, user satisfaction, and structural limitations. For libraries to be sustainable over the long term, previous research highlights the importance of

increasing digital literacy, enhancing infrastructure, and bolstering librarian capacity (Mokhtar et al., 2023; Mansor, Abu & Rafie, 2025). To guarantee inclusion and fair access, policymakers must be in line with national initiatives like the United Nations Sustainable Development Goals (SDGs) (UN, 2015) and the MyDIGITAL Blueprint (Government of Malaysia, 2021).

1. Practical Recommendations (For Librarians and Library Management)
 - a) Conduct regular digital literacy workshops and awareness campaigns to increase user familiarity with integrated technologies.
 - b) Strengthen capacity-building programs for librarians, focusing on ICT skills, digital service management, and sustainability practices.
 - c) Implement feedback mechanisms such as surveys or focus groups to monitor user satisfaction and adapt services accordingly.
2. Policy Recommendations (For PNM, State Authorities, and Government Agencies)
 - a) Allocate dedicated funding to rural public libraries for upgrading infrastructure, ensuring reliable internet connectivity, and maintaining digital tools.
 - b) Integrate RPLs more explicitly into the MyDIGITAL Blueprint and Sustainable Development Goals (SDGs) framework, particularly SDG 4 (Quality Education) and SDG 9 (Industry, Innovation, and Infrastructure).
 - c) Foster partnerships between libraries, schools, and community organizations to expand access and ensure sustainability of digital services.

5.6.1 Future Research

Future research should extend the present study by adopting comparative research designs that examine digital technology sustainability across rural and urban library settings in Malaysia. Such comparisons would allow researchers to identify best practices in digital adoption, highlight disparities in technological capacity and determine which strategies are most effective in different community contexts. Given the rapid evolution of technology, future studies should also explore the potential of emerging tools such as artificial intelligence, block chain-based records and cloud

computing platforms, to enhance library service efficiency, digital resource management and user engagement.

Additionally, longitudinal studies are needed to assess how user engagement, digital literacy levels and satisfaction evolve over time. This would provide evidence on the long-term effectiveness of digital literacy programs and reveal whether initial improvements in digital usage led to sustained behavioral change. Since the current study focuses only on rural public libraries in Pahang, future research could expand to other states or conduct cross-country comparisons to identify universal challenges and region-specific factors influencing digital sustainability.

Future research should also focus on policy and funding mechanisms that support sustainable digital information in rural libraries. Studies examining government- private sector partnerships, community-based funding models and cost sharing strategies could help identify viable approaches for strengthening financial resilience. Finally, future research should investigate librarian capacity building and digital competency frameworks, as strengthening librarian skills is essential for ensuring effective digital service delivery and long-term sustainability in rural public libraries.

5.7 Conclusion

This study sets out to examine the sustainability of digital technology in rural public libraries (RPLs) in Pahang by integrating both librarian and user perspectives. Using an exploratory sequential design, the findings revealed that while users reported relatively high satisfaction with existing digital services, awareness and usage patterns remain uneven. From the librarians' standpoint, challenges such as inadequate infrastructure, limited training, and insufficient funding were identified as key barriers to long-term sustainability.

The significance of these findings lies in demonstrating that user satisfaction alone is not sufficient to guarantee sustainability. Instead, digital transformation in rural libraries requires structural support in terms of resources, professional development, and policy alignment. Real-world relevance emerges in how the results can directly inform the strategies of the National Library of Malaysia (PNM), state library authorities, and local governments in improving digital access and services for rural communities.

This study contributes to the field of library and information science by advancing an integrated framework that links awareness, satisfaction, and sustainability in the context of RPLs. Unlike previous studies that focus primarily on either users or service providers, this research emphasizes the value of triangulating both perspectives. In doing so, it offers a holistic understanding of digital sustainability and positions rural libraries as critical agents in Malaysia's digital transformation agenda.

REFERENCES

- Abdullah, F. A., Omar, S. Z., & Bolong, J. (2013). Behavioral factors influencing usage of rural library services among youth in Malaysia. *Malaysian Journal of Youth Studies*, 8(11), 193–205.
- Abdullah, N., & Kassim, N. A. (2019). The role of rural libraries in community development: A case study of Malaysia. *Journal of Library and Information Science*, 12(3), 45–58.
- Abu, R., Rafie, S. K., & Mansor, M. H. (2024). Digitizing sustainability: Exploring the opportunities and challenges for rural public libraries adopting technology. *International Journal of Research and Innovation in Social Science*, 8(9), 3250–3258.
- Banerjee, A., & Chaudhury, S. (2010). Statistics without tears: Populations and samples. *Industrial Psychiatry Journal*, 19(1), 60–65.
- Bujang, M. A., Omar, E. D., Foo, D. H. P., & Hon, Y. K. (2024). Sample size determination for conducting a pilot study to assess reliability of a questionnaire. *Restorative Dentistry & Endodontics*, 49(1).
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101.
- Chowdhury, G. (2019). Sustainability of digital information services. *Journal of Documentation*, 75(5), 981–995.
- Clarke, V., & Braun, V. (2017). Thematic analysis. *The Journal of Positive Psychology*, 12(3), 297–298.
- City Population. (2023).
- Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches* (4th ed.). Sage.
- Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage.
- Creswell, J. W., & Plano Clark, V. L. (2011). *Designing and conducting mixed methods research*. Sage.
- Cote, C. (2021). *A beginner's guide to data & analytics*. Harvard Business School Online.
- Eldridge, S. (2025). *Data analysis*. Britannica.
- Edmonds, W. A., & Kennedy, T. D. (2016). *An applied guide to research designs: Quantitative, qualitative, and mixed methods*. Sage.

- Fetters, M. D., Curry, L. A., & Creswell, J. W. (2013). Achieving integration in mixed methods designs: Principles and practices. *Health Services Research*, 48(6 Pt 2), 2134–2156.
- Guest, G., Bunce, A., & Johnson, L. (2006). How many interviews are enough? An experiment with data saturation and variability. *Field Methods*, 18(1), 59–82.
- Hayes, A. (2024). Descriptive statistics: Definition, overview, types, and examples. Investopedia.
- Hernon, P., & Altman, E. (2010). Assessing service quality: Satisfying the expectations of library customers. ALA Editions.
- International Federation of Library Associations and Institutions. (2018). Public library services for rural communities: Guidelines for implementation.
- Islam, M. S., & Ahmed, S. Z. (2020). User satisfaction in public libraries: A review of literature. *Library Philosophy and Practice*, 1–15.
- Ismail, N., & Ahmad, F. (2022). Digital transformation in rural libraries: Challenges and opportunities in Pahang, Malaysia. *Malaysian Journal of Library & Information Science*, 27(2), 45–60.
- Jansen, D. (2023). What is research philosophy?
- Latham, B. (2007). Quantitative research methods (ENGL 5377, Spring 2007).
- Lasmana, O., Festiyed, F., Razak, A., & Fadilah, M. (2024). The critical role of instrument design in achieving research objectives. In *International Conference on Education and Innovation* (Vol. 1, No. 1, pp. 70–80).
- Lima, W., & Newell-McLymont, E. F. (2021). Qualitative research methods: A critical analysis. *International Journal of Engineering and Management Research*, 11(2), 189–199.
- Nunamaker, J. F., Chen, M., & Purdin, T. D. (1990). Systems development in information systems research. *Journal of Management Information Systems*, 7(3), 89–106.
- Park, Y. S., Konge, L., & Artino, A. R. (2020). The positivism paradigm of research. *Academic Medicine*, 95(5), 690–694.
- Raosoft. (2025). Sample size calculator.
- Scott, D. M. (2009). Statistics, inferential. In *International Encyclopedia of Human Geography* (pp. 429–435).
- Sheard, J. (2018). Quantitative data analysis. In *Research Methods: Information, Systems, and Contexts* (pp. 429–452). Elsevier.

- Tashakkori, A., & Teddlie, C. (2008). *Mixed methodology: Combining qualitative and quantitative approaches*. Sage.
- Verma, S., Gautam, R. K., Pandey, S., & Mishra, A. (2017). Sampling typology and techniques. *International Journal for Scientific Research & Development*, 5(9).
- Wong, K. K. K. (2013). Partial least squares structural equation modeling (PLS-SEM) techniques using SmartPLS. *Marketing Bulletin*, 24(1), 1–32.
- Kock, F., Berbekova, A., & Assaf, A. G. (2021). Understanding and managing the threat of common method bias: Detection, prevention, and control. *Tourism Management*, 86, 104330.
- Luccy, D., Brophy, J., & Lawson, B. (2024). Building thriving communities: The library's role in economic development. *Journal of Library Administration*, 64, 298–307.
- Martzoukou, K., & Elliott, J. (2016). The development of digital literacy and inclusion skills of public librarians. *Communications in Information Literacy*, 10(1), 99–115.
- Museum and Library Services Act of 2010, Pub. L. 111–340 (2010).
- Osuchukwu, N., & Edewor, N. (2017). Stimulating and enriching partnership with community-based organizations. In *IFLA WLIC 2016 – Connections. Collaboration. Community*. Athens, Ohio.
- Wang, X., & Gao, Y. (2024). The role and function of artificial intelligence and the metaverse in smart libraries. *Applied Mathematics and Nonlinear Sciences*, 9.
- Welser, H., Khan, L., & Dickard, M. (2019). Digital remediation: Social support and online learning communities in rural inequality. *Information, Communication & Society*, 22(6), 717–723.
- Williams, T. A., & Sweeney, D. J. (2025). Hypothesis testing in statistics. *Britannica*.
- Yunus, N., & Ismail, M. (2024). Sustainable libraries: Harnessing smart library for a green future. *Journal of Tourism, Hospitality and Environment Management*.
- Rubin, R. E. (2016). *Foundations of library and information science*. ALA Editions.
- Singh, R., & Mulla, Z. (2021). Digital transformation in libraries: Challenges and opportunities. *Journal of Information Science and Technology*, 15(2), 112–125.
- Venkatesh, V., Thong, J. Y. L., & Xu, X. (2012). Consumer acceptance and use of information technology. *MIS Quarterly*, 36(1), 157–178.

APPENDICES

APPENDIX 1

Questionnaire Development

Questionnaire Development for Technology Awareness and Usage

Operation Definition	Measurement	Source
Technology Awareness and Usage		
Technological Awareness Refers to user understanding and familiarity with the existence, use and benefits of digital technology services provided by Rural Public libraries.	1. I Know about Integrated Digital Technology in Rural Libraries	TAM
Technological Usage Refers to the extent and manner in which users interact with and apply digital technologies in rural public libraries.	1. Internet access speed is the main reason why I go to the village library.	UTAUT
	2. Digital resources in the village library are the main reason why I go to the village library.	TAM
	3. I had positive experiences when using digital services in the village library.	UTAUT
	4. I'm confident in the security and privacy of personal information when using digital services at the village library	UTAUT

Questionnaire Development for User Satisfaction

Operation Definition	Measurement	Source
User Satisfaction		
User satisfaction	1. I am satisfied with the digital services provided in the rural public library.	
	2. I am involved in the development and maintenance of rural libraries through	

	the use of digital technology/
3.	Technological services in rural libraries are accessible to all levels of society.
4.	Digital services in rural libraries benefit the learning and progress of the local community

Questionnaire Development for Digital Technology Sustainability

Operation Definition	Measurement	Source
Digital Technology Sustainability		
Digital Technology Sustainability	1. I know about the issue of digital sustainability and its impact on rural libraries	
	2. There are various sustainability-oriented activities in the application and use of digital technology in rural libraries	
	3. I am satisfied with sustainability-oriented activities in the application and use of digital technology in rural libraries	

APPENDIX 2

Interview Guide

Interview Guide for Digital Literacy Programs, Collaboration and Partnership and Community Engagement

Themes	Question	Source
Digital Literacy Program	1. Does the RPL organize any programs, workshops, or activities that focus on developing users' digital technology skills? 2. Does RPL organize any programs, workshops, or activities that focus on developing users' computer literacy skills? 3. Does RPL organize any programs, workshops, or activities that focus on educating users about internet browsing? 4. Does RPL organize any programs, workshops, or activities that focus on educating users about online safety?	
Collaboration and Partnership	1. Does RPL establish any form of partnership to foster continuing education with local agencies, institutions, associations, or businesses? 2. Does RPL collaborate with local agencies, institutions, associations, or businesses to obtain specific funding, donations, or support to enable RPL to achieve digital advancement?	
Community Engagement	1. Does the PD interact with consumers to understand their digital technology service options?	

APPENDIX 3

Pre-Test – National Library Expert Approval

SELANGOR					
NAMA PD	NAMA PETUGAS	GRED	EMAIL	NO TEL	ZON
PD PARIT 7	FANIZA AKMAL BINTI MUHAIYIDDIN	S 29	pdcbk1b2s29@gmail.com	016 9531983	B1
PD KAMPUNG BUKIT KERAYONG 1	FANIZA AKMAL BINTI MUHAIYIDDIN	S 29	pdcbk1b2s29@gmail.com	016 9531983	B2
PD KG SG KELAMBU	NOR AZIZAH BINTI SABIHIN	S29	penyelia_b3@pnm.gov.my	012 6375094	B3
PD KG HULU CHUCHOH	NOORHASMAYANI BINTI ALI	S 29	penyelia_b4@gmail.com	013-4480128	B4
PAHANG					
NAMA PD	NAMA PETUGAS	GRED	EMAIL	NO TEL	ZON
PD INDERA MAHKOTA	ZULKIFLI BIN MOHD ALI	S 29	penyelia_c1@pnm.gov.my	012-9577147	C01
PD TELUK SENTANG	ROSEMAWATI BINTI MOHD ALI	S 29	penyelia_c2@pnm.gov.my	019-2153627	C02
PD SEBERANG CHENOR	NURUL AFZAN BINTI MOHAMED	S 29	penyelia_c3@pnm.gov.my	014-5135134	C03
PD KG NEW ZEALAND	ASMA' BINTI NAZERI	S 29	penyelia_c4@pnm.gov.my	017-7013171	C04
PD KG. BUKIT BETONG	MOHD HAFIZUDDIN BIN ABU TALIB	S 29	penyelia_c5@pnm.gov.my	019-9412806	C05
PD KG PERPAT	ZAIINTAN MUHAIZA BINTI ZAINUDDIN	S 29	penyelia_c6@pnm.gov.my	011-29302421	C06
PD KG PULAU RUSA	FARIDAH BINTI JUSOH	S 29	penyelia_c7@pnm.gov.my	011-10623775	C07
PD BATU PAPAN	NURUL AFZAN BINTI MOHAMED	S 29	penyelia_c3@pnm.gov.my	014-5135134	C08
PD MASJID KG RELONG	FARIDAH BINTI MUSTAFA	S 29	penyelia_c9@pnm.gov.my	013-2323013	C09
PERAK					
NAMA PD	NAMA PETUGAS	GRED	EMAIL	NO TEL	ZON
PD KG RPT KUAH LUAR	MOHD ROSLI BIN ABDUL RAZAK	S 29	penyelia_a1@pnm.gov.my	019-5936706	A1
PD SUNGAI BAYOR	MARDHIYAH BINTI MOHD NOR	S 29	penyelia_a2@pnm.gov.my	019-4728083	A2
PD TAMAN SERI SELINSING	KHAIRUL BASHARIAH BINTI SAAYA	S 29	penyelia_a3@pnm.gov.my	011-40212671	A3
PD KG ULU KUANG	NOOR SINASURIATIE BINTI MUHAMAD	S 29	penyelia_a4@pnm.gov.my	019-4794303	A4
PD KG TERSUSUN TELUK MEMALI	MOHAMMAD ANUAR BIN HJ MUSTAFA	S 29	penyelia_a5@pnm.gov.my	012-2446343	A5
PD KG TUALANG SEKAH	NUR FARAH AZWIN BINTI MOHD JAILA	S 29	penyelia_a6@pnm.gov.my	017-5515778	A6
PD KG DATO SERI KAMARUDDIN	RASHIDAH BINTI JERI	S 29	penyelia_a7@pnm.gov.my	019-5481796	A7
PD KG TERSUSUN BATU 8	NURUL AINN BINTI ZULIKRAM	S 29	penyelia_a8@pnm.gov.my	012-2105312	A8
PD KAMPUNG KOTA LAMA KANAN	NORHASRIFAH BINTI MAAKHIR	S 29	penyelia_a9@pnm.gov.my	019-5043647	A9

APPENDIX 4

Sample Size Calculator

It show the sample size calculator known as Raosoft was used to determine the recommended sample size for this study

 Raosoft [®] Sample size calculator		
What margin of error can you accept? 5% is a common choice	5 %	The margin of error is the amount of error that you can tolerate. If 90% of respondents answer <i>yes</i>, while 10% answer <i>no</i>, you may be able to tolerate a larger amount of error than if the respondents are split 50-50 or 45-55. Lower margin of error requires a larger sample size.
What confidence level do you need? Typical choices are 90%, 95%, or 99%	95 %	The confidence level is the amount of uncertainty you can tolerate. Suppose that you have 20 yes-no questions in your survey. With a confidence level of 95%, you would expect that for one of the questions (1 in 20), the percentage of people who answer <i>yes</i> would be more than the margin of error away from the true answer. The true answer is the percentage you would get if you exhaustively interviewed everyone. Higher confidence level requires a larger sample size.
What is the population size? If you don't know, use 20000	751660	How many people are there to choose your random sample from? The sample size doesn't change much for populations larger than 20,000.
What is the response distribution? Leave this as 50%	50 %	For each question, what do you expect the results will be? If the sample is skewed highly one way or the other, the population probably is, too. If you don't know, use 50%, which gives the largest sample size. See below under More information if this is confusing.
Your recommended sample size is	384	This is the minimum recommended size of your survey. If you create a sample of this many people and get responses from everyone, you're more likely to get a correct answer than you would from a large sample where only a small percentage of the sample responds to your survey.

AUTHOR'S PROFILE



Mohd Hafidzrizal bin Mansor, 26, is a Master of Science (Information Management) candidate at Universiti Teknologi MARA. His thesis, *Assessing the State of Pahang Librarian Perspectives and User Satisfaction on Digital Technology Sustainability in the Rural Public Library*, explores digital technology sustainability, user satisfaction, and service quality in rural library services. With a strong academic background, he has conducted extensive studies on digital adoption and its impact on rural communities. His work aims to provide practical insights and sustainable strategies for enhancing digital inclusive and improving access to technology in public libraries.

LIST OF PUBLICATION:

Mansor, M. H., & Shahidan, M. N. A. (2021). *Transkrip Temubual Bersama Puan Hajah Zainon Binti Sulaiman Alumni ITM dalam Kursus Sains Perpustakaan*.