MS THESIS

ANALYSIS OF OPEN EDUCATIONAL RESOURCES (OER) ADOPTION AT HIGHER EDUCATION INSTITUTIONS

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This thesis has been accepted by the Department of Educational Leadership & Management (ELM), Faculty of Education, International Islamic University Islamabad in partial fulfillment of the degree of **MS Education**.

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AUTHOR'S DECLARATION

It is hereby declared that the study's author has completed the entire requirement for submitting this research work in partial fulfilment for the degree of MS Education. This thesis, in its present form, is the author's original work, expecting those acknowledged in the text. The material included in the thesis has not been submitted wholly or partially for the award of any other academic certification than for which it is being presented.

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SUPERVISORS' CERTIFICATE

The thesis titled "AN ANALYSIS OF OPEN EDUCATIONAL RESOURCES (OER) ADOPTION AT HIGHER EDUCATION INSTITUTIONS", submitted by Ms Mehr Aymen Shakoor, is a partial fulfilment of the MS degree in Education and has been completed under my guidance and supervision. I am satisfied with the quality of the student's research work and will allow her to submit this thesis for further approval as per IIUI rules and regulations.

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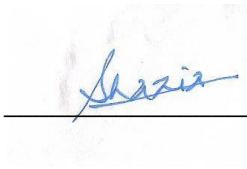
Signature: 

Dr. Shazia Naureen

DEDICATION

To my beloved parents, who always believed,
Their unwavering support, my dreams achieved.
With every step, their love was near,
A guiding light, forever clear.

To my respected supervisor, wise and kind,
In whose guidance, clarity I find.
Your wisdom shared, your patience grand,
You shaped my path with a steady hand.

To my dear husband, partner, and friend,
Your love and strength, a steadfast blend.
Through every challenge, you stood by,
With you, I soar; with you, I fly.

This work is yours as much as mine,
In every word, your essence shines.
A heartfelt thanks, a simple plea,
May this dedication always be.

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Mehr Aymen Shakoor

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List of Abbreviations

OER	Open Educational Resources
HEIs	Higher Education Institutions
CVI	Content Validity Index
EFA	Exploratory Factor Analysis
ICT	Information and Communication Technology
SPSS	Statistical Package for the Social Sciences
TLMs	Teaching and Learning Materials
COL	Commonwealth of Learning
OCW	OpenCourseWare
MIT	Massachusetts Institute of Technology
HEC	Higher Education Commission
VUP	Virtual University of Pakistan
PERN	Pakistan Education and Research Network
NDL	National Digital Library
CC	Creative Commons
OLI	Open Learning Initiative
MHRD	Ministry of Human Resource Development
VUSSC	Virtual University for Small States of the Commonwealth
UAB	Universidade Aberta do Brasil *[Open University of Brazil]*
UNECSO	United Nations Educational, Scientific and Cultural Organization
NCEE	National Center for Education Statistics
ANOVA	Analysis of Variance
NROER	National Repository of Open Educational Resources
TESSA	Teacher Education in Sub-Saharan Africa
IGNOU	Indira Gandhi National Open University
UCT	University of Cape Town
CILT	Center for Innovation in Learning and Teaching
MOOCs	Massive Open Online Courses
IDRC	International Development Research Centre
NOUN	National Open University of Nigeria

Abstract

This study investigated the adoption of Open Educational Resources in higher education institutions in Islamabad, Pakistan. OER adoption is about how an educational institution, educator, or learner integrates openly licensed educational materials into their teaching or learning practices. The objectives were to evaluate the extent of OER adoption initiatives, understand university teachers' perceptions, and identify the challenges and support needed for effective OER adoption. The OER Adoption Pyramid and OER Evaluation Criteria frameworks underpinned the research, employing a descriptive and quantitative design with a positivistic approach. The population included 26 public and private sector universities for web analysis and 4 public sector universities for quantitative analysis. A sample of 22 public and private universities were selected for web analysis. In contrast, 144 faculty members were selected using Krejcie and Morgan's (1970) table, with a 62.34% confidence interval and a 5% margin of error from the 231 targeted population from four public sector universities. Stratified and purposive sampling techniques were used to draw a representative sample. The data were collected using the OER evaluation checklist and the OER stakeholder survey, licensed under CC-BY 4.0. The reliability of the survey and checklist was verified using Cronbach's alpha (.93) and inter-scorer reliability tests, while content validity was assessed through expert reviews. Data analysis involved descriptive statistics using SPSS and quantification of indirect observations using Microsoft Excel. Finally, the findings highlighted the need for increased awareness, capacity building, availability of quality content, and infrastructure to overcome the challenges of OER adoption. The study suggested that these challenges could be addressed through comprehensive policy development and implementation via HEC and HEIs.

Keywords: Open Educational Resources, Innovation, OER Initiatives, Open Content, Open Education, OER Adoption

CHAPTER 1

INTRODUCTION

The advent of digital learning resources has substantially contributed to global educational reform and quality assurance, which aligns with the advancement of information and communication technology in education. Open Educational Resources (OER) are critical, providing several benefits to teachers and students worldwide. The ideology of OER views educational materials as common and public assets that benefit everyone, especially those underserved by current education systems (Rossini, 2010, p. 4). This viewpoint is critical in developing nations like Pakistan, where a lack of educational resources and the pursuit of universal education pose severe obstacles. For instance, Marín et al. (2022) highlighted that while OER holds immense economic potential in improving curricula, facilitating academic collaboration, and enhancing inclusive access to knowledge, its adoption is still nascent, particularly in Asia. Moreover, the limitations of OER utilisation in higher education, such as internet connectivity issues, copyright understanding, and content selection difficulties, indicate the multifaceted challenges that need addressing (Nguyen, Truong, & Nguyen, 2022).

This study explores teachers' awareness, capacity, and availability of OER, along with the challenges and support needed for effective adoption. Thus, this study addresses the gaps in OER adoption and utilisation and aligns with the global discourse on educational equity and access, emphasising the role of OER in educational transformation and development.

1.1 Background and Context of the Study

Over the past 20 years, the demand for easily accessible, high-quality educational materials has significantly increased the global movement toward OER. In 2001, the OER movement garnered widespread support from educational institutions, governments, and international organisations, aiming to democratise access to education and enhance learning outcomes (Galiullina et al., 2019). The UNESCO OER Recommendation, adopted in 2019, highlights the importance of OER by promoting awareness, policy support, and international collaboration to foster the adoption of these

resources (Ossiannilsson et al., 2023). This movement aligns closely with the core values of librarianship, including access, democracy, education, intellectual freedom, and social responsibility, further underscoring the natural synergy between OER and the broader educational mission (Cassidy, Reinauer, & Walz, 2016). This movement from theory to practical application has seen OERs increasingly viewed as a critical component in the quest for educational equity and quality improvement (Hodgkinson-Williams & Arinto, 2018; UNESCO, 2019).

In the context of Pakistan, the Higher Education Commission (HEC) has taken steps to embrace OER through initiatives like the Virtual University of Pakistan (VUP), which has been established to leverage technologies for providing high-quality education at competitive prices (Malik, 2013). However, despite these efforts, Pakistan's higher education system faces challenges related to equity and access, compounded by increased tuition fees due to financial cuts in public sector institutions, which exacerbate the problem of fair access. The digital divide remains a significant barrier to the broader adoption of OER in developing countries. According to Wang and Towey (2017) and Kalyvaki and Bacimanova (2023), challenges to OER adoption span technical, logistical, and pedagogical domains, where faculty members face difficulties in navigating copyright issues, adapting OER content, and embedding these resources within existing curricula.

Additionally, the COVID-19 pandemic has accelerated the need for robust digital infrastructures, faculty training, and policy frameworks to support the sustainable integration of OER (Butako, Kakutia, Shah, & Hunt, 2022). Studies in Sub-Saharan Africa have underscored socioeconomic, cultural, institutional, and national issues as primary barriers to OER adoption, suggesting that the challenges are multi-dimensional and require solutions addressing these varied aspects (Ngimwa & Wilson, 2012). Therefore, Marín et al. (2022) emphasised the importance of individual control, institutional policies, and quality measures in influencing faculty decisions to adopt OER. This points to a need for concerted efforts in professional development, policy formulation, and infrastructure development to support educators in adopting and integrating OER into their teaching practices.

The HEC's initiatives, such as the Pakistan Education and Research Network (PERN) and the National Digital Library (NDL), aim to bridge this divide and enhance

research output and educational quality. According to Zuhairi et al. (2020), OER initiatives in Pakistan have the potential to significantly enhance the quality of education by providing free and open access to high-quality learning materials. This is particularly crucial in a country where educational resources are often scarce and unevenly distributed. However, there is still a need for comprehensive strategies to facilitate the adoption of digital technologies and OER in higher education institutions (Safdar, Baloch, & Nafees, 2013). Moreover, the gender digital divide also poses a challenge, with online education emerging as a potential solution to bridge this gap through skill development and knowledge enhancement (Jumani, Ajmal, Malik, & Maqsood, 2022). Socioeconomic and digital inequalities further impact cybersecurity practices among students, highlighting the intertwined challenges of digital access, security, and education (Khan, Ikram, & Saleem, 2023).

Thus, OER adoption's global and local landscapes underscore a pressing need for strategic approaches to overcome these barriers. Effective strategies encompass fostering institutional policies that support OER, enhancing the digital competencies of educators, and developing mechanisms for the creation, curation, and dissemination of quality OER content (Wang & Towey, 2017). The critical role of educators in this ecosystem cannot be overstated, as their engagement with OER is instrumental in catalysing the shift towards open education practices (Røe, Wojniusz, & Bjerke, 2022). This study intends to learn more about teachers' knowledge, availability, and capability for using OER in connection to their present practices because teachers are key players in the adoption of OER (Allen & Seaman, 2014). In addition, the websites of public and private-sector universities were analysed to investigate the OER initiatives.

1.2 Problem Statement

OER is an emerging trend in Pakistan that is made possible by developing ICTs and open-source technology. Pakistan's higher education system faces limited OER awareness, skills, availability, permission, support, and quality infrastructure. Institutional regulations, individual cognisance, copyright concerns, and proprietary software constraints also hamper the realisation of this shared ideal. The current need is to establish standards for OER or specific examples of OER in Pakistan. Thus, this research examined and investigated the actualisation of open educational resources in the context of Pakistani higher educational institutions by applying quantitative

research methods. The study's findings suggested solutions to solve the challenges related to OER adoption. Thus, the expected outcomes included investigating OER use, awareness, skills, and availability.

1.3 Objectives of Study

i. To evaluate the adoption of open educational resources in higher education institutions of Islamabad.
ii. To compare university teachers' perceptions about adopting OER initiatives at higher educational institutions.
iii. To identify the university teachers' skills to adopt open educational resources.
iv. To examine the perceived benefits of teachers adopting open educational resource initiatives at higher educational institutions.
v. To examine the challenges experienced by higher educational institutions adopting open educational resources.

1.4 Research Questions

RQ.1: How do higher education institutions (HEIs) adopt open educational resources initiatives?

RQ.2: What is the difference between university teachers' perceptions about adopting OER initiatives at higher educational institutions?

RQ.3: What skills do university teachers use to adopt open educational resources?

RQ.4: What benefits do faculty members of higher educational institutions experience when using open educational resources?

RQ.5: What challenges are experienced by faculty of higher educational institutions adopting open educational resources?

1.5 Hypothesis

H_{01}: There is no significant difference in the perceptions of OER adoption between male and female faculty members.

H_{02}: There is no significant difference in the perceptions of OER adoption between Management Sciences and Education Departments.

H_{03}: There is no significant difference in the benefits experienced in OER adoption between male and female faculty members.

H_{04}: There is no significant difference in the benefits experienced in OER adoption Management Sciences and Education Departments.

H_{05}: There is no significant difference in the challenges experienced in OER adoption between male and female faculty members.

H_{06}: There is no significant difference in the challenges experienced in OER adoption between Management Sciences and Education Departments.

H_{07}: There is no significant difference in the skills needed for fostering OER initiatives between male and female faculty members.

H_{08}: There is no significant difference in the skills needed for fostering OER initiatives between the Management Sciences and Education Departments.

H_{09}: There is no significant difference in the perception of OER adoption levels among faculty members from different universities.

H_{10}: There is no significant difference in the benefits experienced in OER adoption among faculty members from different universities.

H_{11}: There is no significant difference in the challenges experienced in OER adoption among faculty members from different universities.

H_{12}: There is no significant difference in the skills needed for fostering OER initiatives among faculty members from different universities.

1.6 Significance of the Study

In the highly competitive arena of higher education, learning materials are often seen as crucial intellectual property. Nevertheless, as a state-of-the-art report on OER initiatives in higher educational institutions, the value will go beyond the usage context.

It is a milestone in adding new scenarios from Pakistani public sector universities to the literature. The study will be helpful for educational reform, policy creation, and surveillance for those working in the Ministry of Education, educational institutions at all stages, and groups from civil society promoting educational progress. This study will address the directors of higher education institutions and policymakers at the national, regional, and intermediate levels. Even though it solely addresses higher education, most concerns are pertinent to the school system and adult education. It would be interesting to learn more about the ramifications of OER creation and usage in schools and universities. However, this study will examine OER-related issues to address four major questions, including how institutions use OER initiatives and what IP rights problems, benefits, and challenges are associated. In addition, to the extent that teachers are aware of OER, what is their capacity to use it, and what is the availability of OER? Finally, the study's findings can guide the development of training programs and support mechanisms to enhance the capacity of educators to utilise OER effectively.

1.7 Delimitations of the Study

This study is delimited to;

i. Federal Charted Higher Educational Institutions in Pakistan
ii. Faculty Members from the Department of Management Sciences and Education
iii. Teachers from Public sector universities
iv. Analysis of websites of Public and private sector universities

1.8 Operational Definitions

The research procedure depends on one's ability to understand crucial phrases. The essential terminology and meanings of this research are listed below:

1.8.1 Open Educational Resources (OER)

Educational materials that are freely accessible and openly licensed allow users to reuse, adapt, and redistribute the content. Examples include textbooks, course materials, videos, tests, software, and other learning tools (Ossiannilsson et al., 2023).

1.8.2 Open Education Resources Importance

Access to high-quality learning and teaching resources is crucial for providing all students with an egalitarian and inclusive education. Open educational resources (OERs) are a modern initiative that has resulted in a significant shift in teaching and learning methods worldwide. The OER Foundation (2011) describes OERs as educational materials providing permits allowing individuals and institutions to reuse, adapt, and modify the content for personal use. OERs include courses, textbooks, streaming videos, tests, software, and other learning materials. Using OERs may significantly improve educational quality and ensure access to diverse, relevant, and current learning resources.

1.8.3 Open Education Resources Initiative

An individual and the leader of an OER resource lead the creation, adoption, or adaptation of OER resources.

1.8.4 Open Education Resources Adoption

OER adoption is defined as how an educational institution, educator, or learner integrates openly licensed educational materials into their teaching or learning practices. To expand access to high-quality educational materials, lower costs for students and institutions, and foster collaborative and participatory learning environments, adopting open educational resources (OER) involves a deliberate effort to include these resources in the curriculum and instruction of a course or program. Successful OER adoption is characterised by increased learner engagement, improved learning outcomes, and cost savings for learners and institutions.

1.9 Theoretical framework

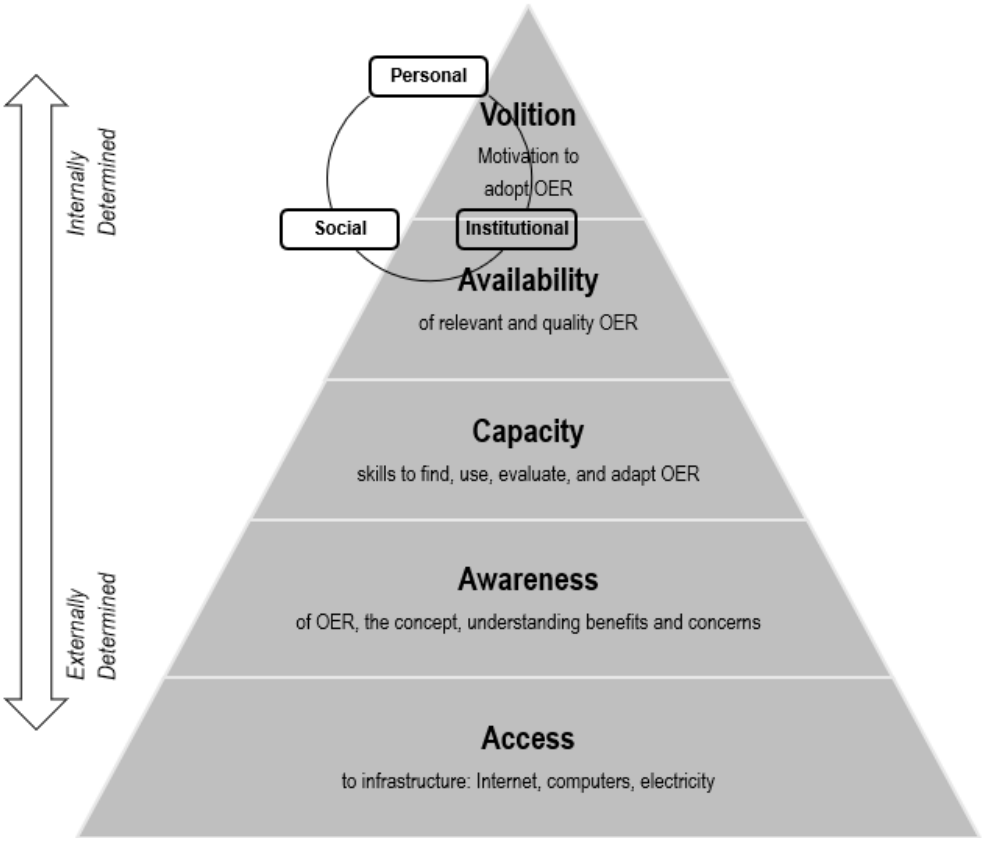
1.9.1 OER adoption pyramid *(Primary Framework)*

The theoretical basis for the study were the adapted OER adoption pyramid framework (Figure 1), which divides the essential OER adoption components into five categories. Nevertheless, this model identifies six levels that influence the adoption of OER; if the bottom layers are ignored, the impact of the upper layers on instructors' engagement in OER will be minimal. Accessible infrastructure, technical prowess,

academic resource endowments, and individual or institutional volition are categorised from more externally driven (bottom) to more individually determined (top) (Cox & Trotter, 2017).

Figure 1.1

OER Adoption Pyramid



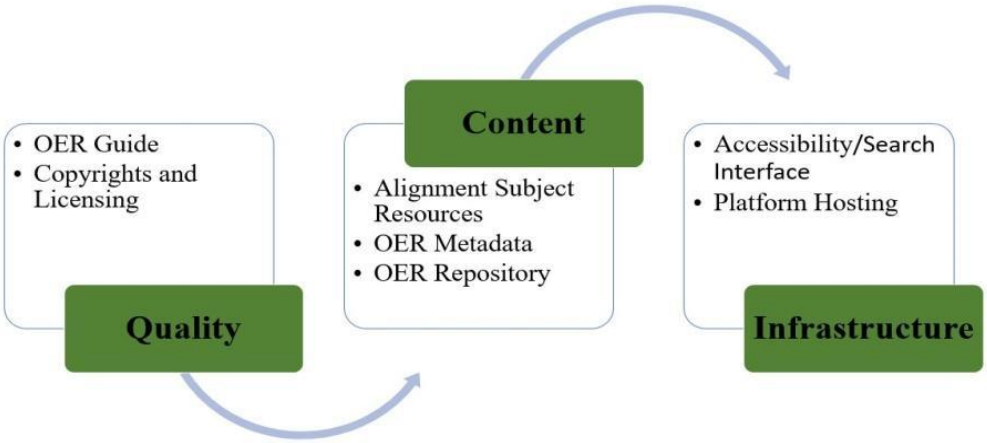
Adapted from *Cox and Trotter (2017)* ***cc-by 4.0***

1.9.2 OER Evaluation Criteria *(Supplementary Framework)*

The OER Evaluation Criteria framework provides a structured approach to assessing the quality and effectiveness of Open Educational Resources. Developed by Elias et al. (2020), this framework categorises evaluation criteria into three primary qualities: quality, content, and infrastructure.

Figure 1.2

Open Educational Resources (OER) Evaluation Criteria



Evaluating OER using these criteria helps educators and institutions make informed decisions about the resources they adopt and integrate into their teaching practices. It also promotes the continuous improvement of OER by identifying areas for enhancement and development.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Open educational resources have played a transformative role in higher education, democratising access to knowledge and promoting innovative teaching practices globally. Adopting and utilising OER can address significant educational challenges, particularly in developing countries like Pakistan, where resource constraints and educational inequities persist. This literature review comprehensively examines the existing research on OER, tracing its historical development, defining its scope, and exploring its theoretical foundations. This chapter delves into the global and regional trends in OER initiatives, highlighting case studies showcasing successes and challenges. The review attempts to identify the benefits and constraints to OER adoption by critically assessing empirical evidence on their impact on learning outcomes and teaching practices. Additionally, the chapter discusses sustainability strategies and policy recommendations essential for the effective integration of OER in educational systems.

2.2 Historical Context and Evolution of OER

2.2.1 Inception and Historical Development

The OER movement originated in the early 2000s, a time of considerable technical developments and rising realisation of the need to make educational resources more accessible and cost-effective to a worldwide audience (Abughres et al., 2020). Before the term "OER" was officially coined, openly sharing educational resources had already gained traction through various initiatives focused on open access and digital learning. For instance, open scholarship and dissemination of educational resources under open licences were prominent in the late 1990s (Naidu, 2019). These early efforts laid the groundwork for a global movement advocating free knowledge exchange. The OER concept was codified during the 2002 UNESCO Forum on Open Courseware, where the term "open educational resources" was introduced. The forum described OER as "educational products that are publicly accessible and openly licenced, allowing for reuse, revision, remixing, and redistribution" (UNESCO, 2002, p. 24). This

concept underlined OER's flexibility and adaptability, making it a vital tool for educators around the world.

2.2.2 Major Global Initiatives

A. Massachusetts Institute of Technology (MIT) OpenCourseWare (OCW)

One of the pioneering endeavours in the OER movement is the MIT, which established its OCW project (Bagar-Fraley, 2022). Launched in 2001, MIT OCW aimed to make the materials from all MIT's courses available online for free, a revolutionary step that set a precedent for other institutions worldwide (Caswell et al., 2008; Hricko, 2021). As of 2020, MIT OCW had published materials from over 2,400 courses, reaching millions of learners worldwide. This initiative has set a benchmark for other institutions and has significantly contributed to the global dissemination of high-quality educational materials.

B. Creative Commons (CC) licences

Several key milestones have marked the development of the OER movement. One notable milestone was the formation of Creative Commons (CC) licenses in 2002, an organisation that provides free legal instruments for sharing and reusing creative works. Creative Commons licenses enabled writers to designate the conditions under which their works might be used, guaranteeing that educational resources could be lawfully shared and altered (Cronin, 2019). As of 2020, over 1.6 billion works were licenced under Creative Commons, many of which are educational resources (Creative Commons, 2020).

C. OER Commons

Another critical development was the launch of various repositories and platforms dedicated to OER. Platforms like OER Commons, launched in 2007, and the European Union's Open Education Europa portal, established in 2013, have played crucial roles in aggregating and disseminating OER globally (Hubina, 2020). These repositories have made it easier for educators to find and use high-quality educational resources, furthering the reach and impact of OER.

D. Cape Town Open Education Declaration

The Cape Town Open Education Declaration was introduced in 2007 to advocate for global open education policies and practices. The Declaration has received support from thousands of individuals and groups, promoting the implementation of OER.

E. Massive Open Online Courses (MOOCs)

Furthermore, the OER landscape saw another significant change with the introduction of MOOCs in the early 2010s. MOOCs, which commonly make use of OER, have democratised access to education by offering students free or inexpensive courses everywhere around the globe. Millions of students worldwide may now access free or inexpensive courses thanks to platforms like Coursera, edX, and Khan Academy, which employ OER. These platforms have democratised access to education, providing opportunities for lifelong learning and skill development to individuals worldwide (Perifanou & Economides, 2021).

F. OpenStax, OpenLearn, and Open Learning Initiative

Rice University's OpenStax initiative exemplifies successful OER adoption in the United States. OpenStax provides free, peer-reviewed textbooks to high school and college students nationwide. By 2021, OpenStax had saved students over $1 billion on textbooks, proving OER's huge financial impact (Bellal et al., 2023). The initiative's success is due to strong institutional support, intensive awareness efforts, and high-quality resources. Following MIT's lead, several significant efforts emerged, including Carnegie Mellon University's Open Learning Initiative (OLI) and the UK's Open University's OpenLearn. The OpenLearn platform provides free access to various courses and educational resources. OpenLearn has reached millions of learners globally, offering over 1,000 free courses. The platform's success is due to its comprehensive content, user-friendly interface, and strong institutional commitment to open education (Cronin, 2019). Therefore, these projects further solidified the OER movement by providing high-quality educational resources to a broad audience and demonstrating the feasibility and benefits of open access to educational content (Smith & Casserly, 2006).

G. European Commission's OpenEdu Framework

The European Commission has been a strong advocate for OER through its OpenEdu framework, which supports the integration of OER into education systems across Europe. According to Bagar-Fraley (2022), the European Commission's 2013 "Opening Up Education" initiative aimed to enhance the quality and accessibility of education using OER. Moreover, the framework provides guidelines and best practices for educational institutions to adopt OER, emphasising the importance of policy support and sustainable practices (Dos Santos et al., 2017). This initiative has facilitated the creation of a robust ecosystem for OER in Europe, promoting innovation and collaboration among educational institutions.

H. Commonwealth of Learning (COL)

An intergovernmental organisation, COL, works to improve and disseminate information, tools, and technology related to online education and open learning. Because of COL, open educational materials, or OER, have benefited greatly from the backing of Commonwealth governments and other poor nations. For students with limited access to high-quality education, COL has expanded educational possibilities through initiatives like the Virtual University for Small States of the Commonwealth (VUSSC) (Kanwar & Uvalić-Trumbić, 2011).

I. UNESCO's Global OER Initiatives

Through several international projects, UNESCO has been promoting open education. The two key texts that have shaped the worldwide OER movement are the 2012 Paris OER Declaration (approved at the World OER Congress) and the 2017 Ljubljana OER Action Plan. These initiatives advocate for policy support, capacity building, and the development of sustainable OER practices, urging governments and institutions to integrate OER into their educational frameworks (UNESCO, 2012; UNESCO, 2017). UNESCO's efforts have significantly raised awareness and facilitated the adoption of OER worldwide.

2.3 Definitions and Scope of Open Educational Resources

2.3.1 OERs

Various organisations and scholars have defined open educational resources, each emphasising accessibility, openness, and educational utility. Teaching, learning, and research materials in any format—digital or otherwise—that are in the public domain or that have been made available under an open license that allows for free access, use, adaptation, and redistribution by others with no or few restrictions are considered OER (UNESCO, 2012, p. 42). This concept emphasised the value of open licensing, which allows instructors and students to access and modify educational materials freely (OECD, 2007). They made it possible for educators to exchange excellent instructional materials, which improved education standards and increased accessibility to learning for a larger audience (Ali & Schroeder, 2019). Meanwhile, Creative Commons defines OER similarly but strongly emphasises the legal aspects of openness. Creative Commons (2017) states that OER "are freely available educational materials that are openly licenced to allow anyone to use, adapt, and share them without restriction legally." This definition highlights the role of Creative Commons licences in facilitating the legal sharing and adapting educational resources.

In addition, David Wiley, a well-known OER enthusiast, provides a practical definition based on the "5Rs" of OER: retain, reuse, revise, remix, and redistribute. These five principles encompass users' OER freedoms, highlighting the ability to access, utilise, change, and redistribute resources in a variety of formats (Wiley, 2019). Furthermore, UNESCO (2007) described OERs as educational materials that contain a complete course, a complete book, or "a more granular item such as a single learning object." In 2008, the William and Flora Hewlett Foundation provided a broader overview of OERs, defining their purpose, types, licensing, and accessibility, stating that OERs are "teaching, learning, and research resources that relate in the public domain or have been issued under an intellectual property licence that allows their free use or re-purposing by others." OERs are complete courses, textbooks, modules, educational materials, video lectures, assessments, software, and other resources, methods, or methodologies that provide access to information (Hewlett Foundation, 2020).

2.3.2 Characteristics and Components of OER

OER includes a variety of educational materials such as course readings, syllabi, lectures, textbooks, assignments, simulations, games, lab activities, quizzes, instructional videos, and courses. According to Hubina (2020), the essential characteristics of OER include accessibility, parallelity, modulation, internationalisation, and coordination. These characteristics offer flexibility and opportunities for an open exchange of teaching practices while incorporating new assessment and collaborative learning approaches.

a. Openness

The primary feature of OER is its openness, which is enabled through open licensing. An open licence enables the copyright holder to give anybody permission to use, adapt, and share the work without requiring extra permits. Examples of Creative Commons licenses range from the most permissive (CC BY) to the most restrictive (CC BY-NC-ND) (Creative Commons, 2020).

b. Flexibility

OER are designed to be adaptable. Adaptation refers to altering OER to fit specific teaching or learning needs. This could involve translating a resource into another language, updating information, or reformatting the content for different educational contexts (D'Antoni, 2009). Educators can modify OER to suit their teaching contexts, cultural settings, and educational needs. This adaptability enhances the relevance and effectiveness of educational resources (Hilton, 2016).

c. Accessibility

OER are meant to be accessible to a wide range of audiences. This includes making resources accessible to people with disabilities and available in several public domain formats. Accessibility also means reducing financial obstacles and providing high-quality education to individuals who cannot afford traditional textbooks and resources (Smith & Casserly, 2006). Furthermore, resources in the public domain are free to use because the intellectual property rights have expired, been surrendered, or

are no longer valid. These materials can be freely used, modified, and distributed without restriction (Bollier, 2002).

2.3.3 Scope of OER

The scope of OER is broad and encompasses various types of educational resources. These resources can be categorised based on their format, purpose, and target educational level. These include:

i. **Textbooks:** allow educators and students to use, change, and share content. OpenStax, for example, offers free peer-reviewed textbooks to high school and college students (Bellal et al., 2023).
ii. **Course modules** offer a wealth of adaptable materials, including syllabi, assignments, and lecture notes designed for usage in a variety of educational settings. This flexibility allows educators and students to adapt to different learning environments.
iii. **Multimedia Resources:** Videos, audio recordings, and interactive simulations promote learning through different content.
iv. **Complete Courses**: Entire courses are free, often through platforms like Coursera, edX, and OpenLearn. These can include all the materials necessary for self-paced learning (Bonk et al., 2015).

The purpose of these resources is to aid educators in delivering instruction, including lesson plans, teaching guides, and classroom activities. Moreover, these materials are aimed at helping students learn and understand subjects, such as study guides, practice exercises, and educational games, and supporting academic research, including datasets, research papers, and reference materials (Fischer et al., 2015). Furthermore, OER is used at various educational levels. For example, OER for K–12 education often focuses on foundational subjects like math, science, and literacy (William & Flora Hewlett Foundation, 2013). Similarly, OER in higher education covers many disciplines and is used to supplement or replace traditional textbooks (Hilton, 2016). Finally, OER resources support adult education and professional development, catering to a diverse audience seeking new skills or knowledge (Wiley & Hilton, 2018).

Therefore, various worldwide and regional initiatives to promote OER's production, distribution, and use have hastened their adoption and usage. The MIT OCW project, UNESCO's Open Educational Resources initiative, and the Creative Commons license system are all important initiatives. These initiatives have played a crucial role in increasing the scope and impact of OER, making high-quality educational resources available to a global audience (Hricko, 2021).

2.4 Theoretical Background

2.4.1 OER Adoption Pyramid

Cox and Trotter (2017) established the OER Adoption Pyramid, which is an extensive structure for understanding the steps of adopting OER. This model categorises the essential components of OER adoption into six hierarchical levels, each representing a critical factor influencing OER adoption and effective use.

2.4.1.1.Infrastructure and Access

The foundational need for adequate infrastructure and technological access lies at the pyramid's base. This level emphasises the importance of ensuring educators and learners have the necessary technological resources, such as reliable internet access, digital devices, and technical support. Without these fundamental prerequisites, the adoption of OER is significantly hindered (Herbert et al., 2023). In many underdeveloped nations, low access to technology and internet connectivity is a substantial impediment to the widespread use of OER (Bagar-Fraley, 2022; Kanwar et al., 2010). For instance, a study by the Commonwealth of Learning highlighted that only 34% of households in sub-Saharan Africa have internet access, which severely limits the potential reach of OER (COL, 2017).

2.4.1.2.Legal and Policy Framework

The second level addresses the legal and policy frameworks that support OER adoption. This includes understanding and navigating issues related to intellectual property rights, copyright laws, and open licenses, such as those provided by Creative Commons. Educators and institutions must know how to legally use, adapt, and distribute OER to avoid potential legal pitfalls and promote a culture of sharing and

openness (Cronin, 2019). National and institutional policies that encourage the use of OER are also critical at this stage. Moreover, Wiley et al. (2014) found that awareness and understanding of open licences significantly influence the adoption of OER among educators.

2.4.1.3.Conceptual Awareness and Understanding

This level focuses on the conceptual understanding of OER among educators and stakeholders. It involves raising awareness about OER, its benefits, and how it differs from traditional educational resources. Effective professional development and training programs equip educators with the knowledge and skills to incorporate OER into their teaching techniques (McBride & Abramovich, 2022). According to Ozdemir and Bonk (2017), conceptual awareness also includes comprehending the pedagogical benefits of adopting open educational resources, such as increased student involvement and the opportunity to tailor learning materials.

2.4.1.4.Availability and Quality of Resources

The fourth level pertains to the availability and quality of OER. Educators require access to a diverse set of high-quality, relevant, and dependable OER that can be effortlessly integrated into their curricula. This requires developing and maintaining comprehensive OER repositories and platforms where educators can find and share resources (Lantrip & Ray, 2021). Ensuring the quality of OER involves rigorous peer review processes and continuous improvement based on user feedback. According to Bliss et al. (2013), faculty members are hesitant to use OER due to concerns about their quality.

2.4.1.5.Institutional Support and Encouragement

Institutional support is crucial in the implementation of OER. Recognising, rewarding, and offering professional development opportunities are examples of incentives for educators to use and provide open educational resources. Institutions can also encourage OER adoption by incorporating it into their strategic plans and establishing an open and collaborative culture (Herbert et al., 2023). For example, the University of Edinburgh has built thorough policies and support mechanisms to encourage OER use, leading to widespread adoption across several departments

(Campbell et al., 2023). Leadership and administrative support are vital for creating an environment where OER can thrive.

2.4.1.6.Personal Volition and Motivation

At the apex of the pyramid are personal volition and motivation. This level represents the educator's willingness and drive to adopt and use OER. Perceived ease of use, usefulness, and compatibility of OER with personal teaching philosophies and practices are all factors that influence personal motivation (McBride & Abramovich, 2022). Autonomous motivation, or the intrinsic desire to improve student learning and engagement, is often the strongest predictor of an educator's decision to adopt OER (Herbert et al., 2023).

2.4.2 OER Evaluation Criteria

Evaluating open educational resources involves comprehensively assessing their quality, content, infrastructure, and accessibility. Elias et al. (2020) developed a robust framework for evaluating OER that addresses these critical criteria, ensuring that educational resources meet the needs of learners and educators while maintaining high standards of educational quality.

2.4.2.1.Quality

Quality is a paramount criterion in evaluating OER. It encompasses the accuracy, relevance, and educational value of the resources. High-quality OER should provide accurate and up-to-date information, be relevant to the intended educational context, and contribute significantly to the learning objectives (Elias et al., 2020). For instance, OpenStax, a primary provider of free, peer-reviewed, openly licensed textbooks, ensures high quality through rigorous peer review. Their textbooks are evaluated by subject matter experts and educators to ensure correctness and relevancy. This method not only improves the products' credibility but also guarantees that they fulfil the educational demands of varied student populations (Bellal et al., 2023).

2.4.2.2.Content

The content criterion evaluates the comprehensiveness, depth, interoperability and flexibility of the OER. A comprehensive OER covers the subject matter extensively, providing enough depth to facilitate thorough understanding. Interoperability refers to the ability of OER to integrate seamlessly with other educational technologies and platforms. The sharing of OER and the ability for learning tools to talk to each other are made more accessible by standards like SCORM and LTI (Johnson et al., 2016). Moreover, flexibility refers to adapting and modifying the content to suit different educational contexts and learner needs (Hubina, 2020). For instance, Khan Academy exemplifies high-quality content by offering various instructional videos and practice exercises across various subjects. These resources are designed to be modular, allowing educators to integrate them into their curricula in ways that best fit their teaching strategies and student needs (Lantrip & Ray, 2021).

2.4.2.3.Infrastructure

Infrastructure refers to the technical framework supporting OER, including the platforms and tools used to access, manage, and distribute these resources. Adequate infrastructure ensures that OERs are easily accessible, user-friendly, and supported by robust digital tools that facilitate their integration into educational systems (Jangulova, 2020). Furthermore, Universal Design for Learning (UDL) principles encourage the development of educational resources that address diverse learning needs and preferences. This includes providing content in multiple formats (text, audio, and video) and incorporating flexible options for engagement and assessment (CAST, 2018). Therefore, implementing UDL in OER design ensures that resources are accessible to many learners. For example, the European Union's Open Education Europa portal provides a centralised platform where educators and learners can access various OER. The portal is designed to be intuitive and user-friendly, with powerful search and filter capabilities that make it easy to find relevant resources. Additionally, it supports various formats and provides tools for collaboration and sharing (Perifanou & Economides, 2021).

2.4.2.4.Accessibility

Accessibility is a critical criterion for making OER useable by all learners, especially those with disabilities. OER should adhere to existing accessibility standards, such as the Web Content Accessibility Guidelines (WCAG). According to Peignen (2024), these recommendations serve as a framework for improving web content accessibility for individuals with impairments. The European Union's Web Accessibility Directive requires that public-sector websites and mobile applications, including educational resources, adhere to WCAG criteria (Redecker, 2017). For example, the University of California's OER platform includes accessibility capabilities, including text-to-speech, customisable text size, and high-contrast mode, making educational resources available to students with visual impairments and other disabilities. This commitment to accessibility ensures that all students can benefit from the resources, regardless of their physical abilities (Van Der Berg & du Toit-Brits, 2023).

Table 2.1.

OER Evaluation Criteria and its Indicators Analysis

OER Evaluation Criteria	***Quality***	***Content***	***Infrastructure***	***Accessibility***
Indicators	The content must be factually correct and up to date.	Comprehensiveness (coverage of the subject matter in full scope.)	Resources must be easily accessible through reliable platforms.	Adherence to established accessibility standards (e.g., WCAG).
	The material should align with curriculum standards and learning outcomes.	Providing detailed and in-depth explanations of concepts.	The platform should offer an intuitive and seamless user experience.	Inclusive design features that cater to the needs of diverse learners.
	The resources should support effective teaching and learning practices.	Flexibility in adapting and customising the material.	Availability of tools to manage, adapt, and share OER.	Assistive technology support, including screen readers and text-to-speech applications.

2.5 Empirical Studies on OER Adoption

2.5.1 Global Perspectives

The adoption of OER has varied significantly across regions due to various factors, including technological infrastructure, educational policies, cultural

acceptance, and institutional support. For instance, strong advocacy from North American educational institutions and funding agencies has fueled OER adoption, increasing awareness and usage among teachers and students. A study by Spilovoy, Seaman, and Ralph (2020) highlighted that nearly 30% of faculty in the United States had integrated OER into their courses, a significant increase from previous years, primarily due to initiatives by state and federal governments to promote open-access educational resources.

The European Commission's Open Education Europa initiative, which aims to introduce cutting-edge teaching methods to educational institutions all over the continent, has sped up the adoption of OER in Europe. According to Otto, Schroeder, and Diekmann (2021), the European region has witnessed a steady growth in OER adoption, with countries like the United Kingdom and Germany leading the way. These countries have established comprehensive national strategies for OER, supported by policies that encourage developing and disseminating open resources. In contrast, Asia presents a mixed picture in terms of OER adoption. Countries like Japan, South Korea, India, and Indonesia have made significant strides through national initiatives and international collaborations. The Ministry of Human Resource Development established India's National Repository of Open Educational Materials (NROER), which offers a comprehensive range of digital materials in many languages to satisfy the country's educational needs (Perifanou et al., 2021). Furthermore, Tlili et al. (2020) found that attempts to promote OER have gained traction in Arab countries. However, issues such as language difficulties, a lack of digital skills, and limited technical access remain. In contrast, government-backed initiatives to improve educational quality and access have helped countries like China rapidly expand OER (like MOOCs) (Miao et al., 2016).

Furthermore, Africa faces unique challenges in OER adoption due to disparities in digital infrastructure and educational resources. However, initiatives such as the African Virtual University and the TESSA (Teacher Education in Sub-Saharan Africa) project have been pivotal in promoting OER across the continent. According to Tlili et al. (2022), these initiatives have helped bridge educational gaps, though the overall adoption rates still need to be higher in other regions. Overall, while the global orientation of OER adoption is diverse, common themes such as the need for supportive

policies, digital infrastructure, and cultural acceptance emerge as critical factors influencing the uptake of OER. Comparative studies, such as Otto et al. (2021), provided valuable insights into the differences in adoption rates and behaviours, stressing the significance of specialised methods to address the individual demands of each location.

2.5.2 Case Studies

A. United States

The Maricopa Community Colleges system has spearheaded the OER movement in the United States. Since its inception in 2013, the district's Maricopa Millions OER Project has saved students over $10 million on textbooks. According to Spilovoy, Seaman, and Ralph (2020), this initiative emphasised the critical role of institutional commitment and strategic funding in driving OER adoption. Moreover, the University of California, Davis (UC Davis) has also been at the forefront of OER adoption in the United States. The AggieOpen initiative intends to lower textbook prices for students by increasing the use of open educational resources (OER). Since its beginning, the initiative has saved students over $1 million in textbook costs. The key to UC Davis's success has been institutional solid support, a dedicated team for OER development, and partnerships with faculty to create and adopt high-quality OER materials (Bellal et al., 2023).

B. North America

Athabasca University, a Canadian distance education leader, integrated OER into its curriculum to enhance access and reduce student costs. The university's "Athabasca University Press" publishes open textbooks and other free educational materials for learners worldwide (Ives & Pringle, 2013). This strategy has significantly reduced the cost of course materials for students while extending the university's educational offerings. Opening open courses at Athabasca University has been a remarkable success, allowing students to access high-quality educational content without the price constraints associated with traditional textbooks. This has particularly benefited students in remote and underserved areas, aligning with the university's mission of providing accessible education (Ives & Pringle, 2013). However, the

challenges included the scalability of OER initiatives and the need to continuously update materials to ensure their relevance and accuracy. Additionally, securing sustainable funding for the development and maintenance of OER has been a persistent challenge.

C. Europe

National initiatives like the UK Open Textbook Project and the OER Hub have supported the adoption of OER in the UK. Moreover, the University of Edinburgh pioneered the UK's embrace of OER. Established in 2015, the university's OER policy fosters OER's creation, usage, and dissemination throughout its faculties (Campbell et al., 2023). The institution's extensive support system, which includes staff professional development programs, specialised OER repositories, and integration with its learning management system (LMS), is proof of its dedication to open education. However, one of the University of Edinburgh's significant achievements is constructing the "Open. Ed" platform, which offers a range of OER, such as lecture materials, course guides, and interactive tools. This platform has improved the accessibility of instructional resources for students and educators, both inside and beyond the university. Additionally, Otto et al. (2021) noted that the institution’s approach to embedding OER within its teaching and learning strategies has significantly enhanced educational accessibility and innovation.

Despite these successes, the University of Edinburgh faced challenges in the initial stages of OER adoption. These included resistance from some faculty members who were accustomed to traditional teaching methods and concerns about the quality and sustainability of OER. To address these issues, the university implemented a robust quality assurance process and provided ongoing support and training for staff.

D. Asia

National policies supporting the development and use of open resources have helped Japan's Open University in Asia successfully integrate OER into its curriculum. According to a study by Tlili et al. (2020), the university's comprehensive digital infrastructure and solid governmental support have been critical factors in its successful OER adoption. In addition, India's Indira Gandhi National Open University (IGNOU) is one of the world's largest open universities, and it has effectively integrated OER into

its instructional system (Saikia, 2024). IGNOU's OER project has created a variety of open course materials, including textbooks, lecture notes, and multimedia resources, which are accessible via its online platforms (Miao et al., 2016). The collaborative production of OER with other educational institutions and organizations, both in India and beyond, has been a significant accomplishment at IGNOU. This partnership has enhanced the quality and diversity of educational resources available to students and has fostered the exchange of information and best practices (Miao et al., 2016). However, IGNOU has faced challenges related to the digital divide, as many students come from rural areas with limited internet access. Additionally, ensuring the quality and relevance of OER across a vast and diverse student population has been a significant challenge.

E. South Africa

The University of Cape Town (UCT) promotes free educational materials in South Africa. The university's Centre for Innovation in Learning and Teaching (CILT) has developed a comprehensive open educational resource (OER) strategy that involves creating and disseminating open materials. UCT's OER efforts have enhanced students' access to instructional resources and fostered a collaborative culture among academics. Despite these advances, financial and infrastructure constraints remain (Van Der Berg & du Toit-Brits, 2023). Furthermore, the National Open University of Nigeria (NOUN) has used OER to meet the educational demands of a diverse and geographically dispersed student body, providing open course materials corresponding to the national curriculum (Olufunke & Adegun, 2014). The Commonwealth of Learning has supported NOUN's OER initiative, which has focused on creating and disseminating open course materials across various disciplines (Kanwar et al., 2010). This effort has considerably enhanced access to education for students from rural places who encounter hurdles to traditional higher education.

Furthermore, NOUN has reported increased student enrollment and retention rates attributed to the availability of OER (Kanwar & Uvalić-Trumbić, 2011). However, there is limited internet access and digital literacy among students and faculty. Additionally, there have been difficulties in obtaining regular funding for the development and maintenance of OER. Thus, the NOUN case study demonstrates the significance of overcoming technology impediments while also providing proper

training and assistance to students and educators. Building partnerships with international organisations can also provide the necessary resources and expertise to sustain OER initiatives.

F. Latin America

Finally, the OER effort of the Tecnológico de Monterrey in Mexico has been notable in Latin America. The institution's focus on open textbooks and educational resources has significantly reduced student costs and improved access to quality educational materials. According to Rodés and Gewerc (2021), the success of this initiative underscores the importance of institutional leadership and a supportive policy environment. These case studies illustrate that while the path to successful OER adoption varies, common elements such as institutional commitment, supportive policies, and robust digital infrastructure are essential. The lessons learned from these institutions provide valuable insights for other educational entities looking to implement or expand their OER initiatives.

2.6 OER in Pakistani Higher Education

The adoption of OERs in Pakistan is still nascent despite the country's pressing need for accessible and affordable educational materials. Several initiatives have been undertaken to promote OER within Pakistani higher education institutions, with varying degrees of success. Pakistan's HEC has played a pivotal role in these efforts, spearheading various projects. One notable project is the construction of the PERN, which provides high-speed internet connectivity to universities and research organisations nationwide. PERN allows access to an extensive array of digital materials, including OER, enabling universities to incorporate these resources into their courses (HEC, 2021).

The HEC has also created the National Digital Library Programme, which provides access to various academic publications, databases, and e-books. This programme is not only focused on OER but also enhances OER activities by providing a core digital infrastructure for open resources. The HEC also encouraged universities to develop and distribute their OER, thus creating a culture of collaboration and resource sharing among the academic community (HEC, 2021).

Furthermore, Allama Iqbal Open University, one of the world's largest open institutions, has adopted OER to some level by providing open course materials and tools to support its distance learning programs. The university's initiatives aim to expand educational opportunities for individuals who cannot attend traditional on-campus programmes, thereby contributing to the democratisation of education (Mehmood et al., 2016). Similarly, the Virtual University of Pakistan (VUP) has pioneered OER, offering various courses and educational materials under open licenses. This effort has proved the capacity of OER to improve educational access and quality, particularly in locations where traditional educational resources are limited (Malik, 2013). The VUP's efforts have been instrumental in promoting open education in Pakistan.

Despite these efforts, the uptake of OER in Pakistani higher education still needs to be improved. According to Lou et al. (2020), only a small percentage of faculty members actively use OER in their teaching. The study highlights numerous challenges to OER adoption, including a need for increased awareness, insufficient technological skills, and concerns about the quality and usefulness of accessible resources. The need for a comprehensive national policy on OER, which would offer institutions a clear framework and incentives to adopt open educational practices, exacerbates these difficulties.

2.6.1 Faculty Perceptions and Practices

2.6.1.1.Faculty Awareness and Use of OER

Faculty perceptions and practices regarding OER in Pakistan reflect a mixed understanding and usage of these resources. While there is widespread awareness of OER among faculty members, Awan, Afshan, and Memon (2018) found that this awareness only occasionally translates into widespread use. The survey, which included responses from 200 faculty members across various public universities, indicated that only 25% of respondents had incorporated OER into their teaching practices. The critical reasons for this restricted use were a need for more technical skills, insufficient institutional support, and worries about the quality of OER. In addition, according to a Babson Survey Research Group survey, 13% of American faculty members reported using free educational resources in their classes in 2019 (Seaman & Seaman, 2020),

and 46% were aware of OER. This awareness is a critical first step towards adoption, as faculty need to be knowledgeable about OER to consider integrating them into their teaching.

In Pakistan, faculty awareness of OER is gradually increasing because of initiatives by the HEC and other organisations. For example, Asghar et al. (2021) discovered that whereas 60% of faculty members were aware of OER, only 25% had implemented it in their teaching practices. This disparity between awareness and usage suggests that extra support and incentives may be required to boost the adoption of OER.

2.6.1.2.Perceived Benefits of OER

Faculty members acknowledge various advantages to using OER in their teaching. Students will save money, which is one of the key benefits. Traditional textbooks might be prohibitively expensive, whereas OER provides a free or low-cost alternative that considerably reduces students' financial burden (Hilton, 2020). For example, Hendricks, Reinsberg, and Rieger (2017) conducted a study at the University of British Columbia to investigate student impressions of OER. According to the study, 82% of students favoured open educational resources (OER) over traditional textbooks for cost savings, convenience of access, and the capacity to retain materials beyond the course. Students also reported that using OER positively affected their learning experiences, as they could access the materials anytime and, on any device, facilitating continuous learning and review.

Additionally, Bliss et al. (2013) discovered that professors who used OER did so to reduce the high cost of textbooks for their students. Another claimed advantage is the flexibility and adaptability of OER. Faculty value the opportunity to tailor and adapt OER to their educational environments and course objectives. This customisation enables instructors to modify materials to fit their students' requirements better, increasing the relevance and efficacy of the learning experience (Wiley & Hilton, 2018).

Furthermore, OER can enhance access to diverse, high-quality educational materials. Faculty members value the opportunity to access and share a wide array of

resources, enriching their teaching and providing students with a broader perspective on the subject matter (Jhangiani et al., 2016). In addition, Shams, Haq, and Waqar et al. (2020) stated that faculty members see various benefits to using OER, including financial savings for students, enhanced access to current materials, and improved teaching practices through diverse resources. However, significant obstacles like the need for more excellent knowledge about licensing issues, limited access to high-quality OER, and the absence of a supportive policy framework at the institutional level frequently overshadow these alleged benefits (Cox, 2013).

2.6.1.3.Perceived Barriers to OER Adoption

Despite the recognised benefits, several barriers hinder the widespread adoption of OER among faculty. One significant barrier is the need for more awareness and understanding of effectively finding, using, and integrating OER into teaching practices. Faculty members may need to become more familiar with the available OER repositories or need more skills to adapt and implement these resources (Mishra, 2017; Mishra, 2021). Concerns about the quality and legitimacy of open educational resources pose an additional issue. Some faculty members were found to be hesitant to adopt OER due to doubts about the accuracy and reliability of the content. Therefore, ensuring rigorous quality assurance processes and providing peer-reviewed OER can help mitigate these concerns (Cox & Trotter, 2017; Cox, 2016). Additionally, the time and effort required to identify, adapt, and use OER might be discouraging for faculty. Educators often need more time constraints, and the perceived additional workload associated with OER can discourage their use. Institutional support, such as professional development and incentives, is essential to address this barrier and facilitate adoption (Hodgkinson-Williams & Arinto, 2017).

2.6.2 Institutional Support and Policies

Institutional support and policies are crucial for adopting and integrating OER into higher education. In Pakistan, while some institutions have taken steps to promote OER, a comprehensive and coordinated policy framework still needs to be developed. Lou, Hostetler, Freeman, and Stefaniak (2020) argue that clear and consistent standards that give criteria for the creation, use, and dissemination of OER are required. These rules should cover topics such as intellectual property rights, quality assurance, and the

inclusion of OER-related activities in academic assessments. Furthermore, policies should focus on increasing educators' capacity to use and generate OER through professional development programs and technical assistance (Shams et al., 2020). Furthermore, universities might encouraged to utilise OER in their strategic goals and give incentives for faculty to use and generate open resources. This could include recognition and rewards for OER-related activities and funding for developing high-quality OER (Awan et al., 2018).

Therefore, the role of institutional culture in shaping faculty perceptions and practices is critical. Lou et al. (2020) noted that universities that actively promote and support OER initiatives tend to have higher levels of faculty engagement with open resources. This support can take various forms, including professional development programmes, technical assistance, and recognition of OER-related activities in faculty evaluations and promotions. For instance, faculty members at VUP report positive experiences with OER, citing improved access to diverse teaching materials and enhanced student engagement as significant benefits (Malik, 2013).

2.6.3 Comparative Analysis with Global OER Initiatives

Establishing the National Digital Library, the Pakistan OER Portal, and supporting institutions like the VUP and AIOU demonstrated the country's commitment to enhancing educational access through OER. Similarly, the National Digital Library of India (NDLI) is a critical initiative that provides access to a vast repository of educational resources in India. Furthermore, the Ministry of Human Resource Development (MHRD) established the National Programme on Technology-Enhanced Learning (NPTEL), which offers free online courses and resources given by prominent Indian institutions (MHRD, 2019). India's approach focuses on leveraging technology to reach a large and diverse student population, like Pakistan's efforts with VUP and AIOU. Moreover, the University of Cape Town (UCT), South Africa, initiated the OpenUCT platform for sharing educational resources and research outputs (Cox & Trotter, 2017). The South African government also supports OER through policies that encourage open access to educational materials. However, South Africa's OER initiatives often include a vital research component, integrating academic outputs into OER platforms, and developing policies regarding intellectual property and open licensing, which may be emphasised in Pakistan.

Furthermore, the Open University of Brazil (UAB) provides distance learning courses to students nationwide, incorporating OER into its curriculum. The government's e-Tec Brasil programme supports technical and vocational education through open resources (Amiel, 2013). However, unlike Brazil, Pakistan has yet to establish a prevalent public-private partnership that enhances resource availability and sustainability. Therefore, the success of OER initiatives in developing countries often hinges on strong governmental and policy support, institutional collaboration, addressing diverse educational needs, and sustainable funding models. Countries like India and South Africa illustrated how comprehensive policies and strategic government interventions can promote widespread OER adoption. Secondly, India's partnerships with top institutions and South Africa's integration of research into OER platforms highlighted the importance of institutional collaboration in creating high-quality resources. Third, addressing varied educational needs through specialist curricula, such as Brazil's technical and vocational focus, can considerably increase the relevance and impact of OER. This strategy can aid Pakistan by catering to a variety of educational areas. Finally, sustainable funding options, including public-private partnerships, are critical to the long-term sustainability of OER efforts. Brazil's approach provides valuable insights into how partnerships can support and sustain OER projects.

2.7 Challenges and Barriers to OER Adoption

2.7.1 Technical Barriers

Various technical barriers significantly influence the adoption of OER. Infrastructure limitations and technological challenges are among the primary obstacles. Furthermore, issues with accessibility and usability are critical technical barriers. OER must be accessible to all users, including people with impairments. This includes adhering to accessibility standards like the Web Content Accessibility Guidelines (WCAG). Unfortunately, many OERs fail to meet these criteria, making it impossible for all students to benefit. According to Tlili et al. (2020), a significant portion of available OER is inaccessible to learners with visual, auditory, or motor challenges, limiting their inclusivity.

2.7.1.1.Infrastructure Limitations

Infrastructure limitations, such as inadequate internet connectivity and insufficient technological infrastructure, pose significant obstacles to using OER effectively. In many developing countries, the lack of reliable internet connectivity and insufficient access to digital devices pose substantial barriers to the effective utilisation of OER (Adil et al., 2024). In many rural and remote areas of Pakistan, internet access is either unavailable or unreliable, severely restricting students and educators' ability to access and utilise OER (Mehmood et al., 2016). According to research by the International Telecommunication Union (2020), just 35% of Pakistan's population has internet connectivity, underscoring the digital gap that limits educational opportunities. Furthermore, Ouma (2019) emphasised the challenges universities experience in managing and offering learner support for in-service teachers participating in distant education in Uganda, owing to insufficient infrastructure and technology skills. Therefore, with the necessary infrastructure, students and educators can access, use, and benefit from OER.

2.7.1.2.Technological Challenges

Even in areas with internet access, technological challenges such as outdated hardware, lack of digital literacy, and limited technical support can hinder the effective use of OER. Many educational institutions in Pakistan need more IT infrastructure and technical expertise to support adopting and integrating OER into their curricula. The lack of training and professional development resources that allow educators to increase their digital competencies exacerbates this issue (Butt & Qaisar, 2017). Therefore, Hodgkinson-Williams and Arinto (2017) stated that training and support are essential to overcome these technical barriers, but such initiatives often need to be improved in many educational institutions.

2.7.1.3.Issues with Accessibility and Usability

Issues with accessibility and usability complicate OER implementation. To be effective, OER must be designed to be accessible to all users, including those who are disabled. This includes adherence to accessibility standards such as the Web Content Accessibility Guidelines (WCAG) (Mtebe & Raisamo, 2014). However, many OERs fail to meet these standards, making it difficult for all students to benefit. For example,

Dieu and Tam (2023) identified that a lack of technical skills and support from faculty were significant barriers to the effective use of OER among students in Vietnam. According to Tlili et al. (2022), a significant percentage of available OER is not accessible to learners with visual, auditory, or motor impairments, limiting their inclusivity. Additionally, language barriers can limit the usability of OER, as many resources are available only in English, which is not the primary language of instruction for a large portion of the Pakistani population (Asghar et al., 2021). Ensuring that OER is accessible and usable for all learners requires careful consideration of these factors and the implementation of inclusive design principles.

2.7.2 Economic Barriers

2.7.2.1.Funding Issues

Economic barriers significantly impact the adoption and sustainability of OER, particularly in resource-constrained environments. Funding issues and cost-related obstacles are prevalent, particularly in developing countries. Developing, maintaining, and disseminating high-quality OER requires substantial financial resources. When budgets are tight, institutions frequently need assistance allocating enough money for these activities (Adil et al., 2024).

2.7.2.2.Cost-Related Obstacles

Moreover, the initial costs associated with transitioning to OER can be prohibitive. This includes costs for training educators, creating new materials, and incorporating OER into existing educational frameworks. Although OER can result in long-term cost reductions for institutions and students, the initial expenditure can be a disincentive (Lima-Lopes & Biazi, 2021). Meanwhile, McGowan (2020) noted that institutional support mechanisms, such as faculty mini-grants and stipends, are critical in encouraging faculty to adopt and adapt OER.

2.7.2.3.Economic Sustainability

While OER is freely available to users, the production and maintenance of these resources require a sustainable funding model. Public-private partnerships, philanthropic support, and government funding are potential avenues for achieving

sustainability, but securing consistent and long-term financial support remains a critical challenge (UNESCO, 2019). Once the initial funding is exhausted, institutions may need help maintaining and updating their OER initiatives. According to Dutta (2016), the need for sustainable funding models is a significant barrier to the long-term success of OER projects.

2.7.3 Social Barriers

2.7.3.1.Cultural Resistance

In many educational institutions, there is a solid attachment to traditional teaching methods and materials. Faculty members may avoid implementing new pedagogical approaches or incorporating OER into their teaching practices. This resistance is often based on worries about the quality and legitimacy of OER, as well as a reluctance to stray from existing norms and practices (Butt & Qaisar, 2017). Therefore, Durham and Braxton (2020) highlighted the importance of collaborative leadership and stakeholder engagement in overcoming faculty resistance and promoting the adoption of OER.

2.7.3.2.Lack of Awareness

Another big societal obstacle is the need for more knowledge about open educational resources. Many educators need to be educated on what OERs are, how to obtain them, and how to incorporate them into their classroom activities. Hussain et al. (2019) discovered that just 25% of Pakistani academic members employed OER, despite 60% being aware of them. Similarly, Baas, Admiraal, and Berg (2019) discovered that informal resource sharing among personal networks was standard at the Dutch University of Applied Sciences. However, the institutional adoption of OER was limited due to insufficient awareness and support from higher management. This gap between awareness and usage indicates that more needs to be done to educate stakeholders about the value and potential of OER. Thus, awareness-raising campaigns, workshops, and training sessions can help bridge this gap and encourage greater adoption of OER.

Thus, social norms and attitudes towards sharing and collaboration can influence the adoption of OER. In some educational cultures, there is a preference for

proprietary materials and a reluctance to share resources openly. This cultural barrier can be challenging to overcome, as it requires a shift in mindset towards valuing open collaboration and sharing (Hodgkinson-Williams & Arinto, 2017). Moreover, successful OER initiatives often involve a top-down approach where institutional leaders champion the cause and encourage their faculty to embrace open education (Muslim, Touseef, & Raza, 2018).

2.7.4 Legal Barriers

2.7.4.1.Intellectual Property Issues

Intellectual property (IP) issues are a significant concern in the context of OER. The creation and distribution of OER often involve multiple authors and contributors, raising questions about the ownership and rights to the content. Educators and institutions may need clarification about the legal implications of using and sharing OER, which can lead to reluctance to adopt these resources. Understanding and navigating the complexities of open licenses, such as those provided by Creative Commons, requires a certain level of legal literacy that many educators may need to gain. Bradlee and VanScoy (2019) found that while faculty members valued the support of librarians in navigating these legal complexities, there was still a need for greater clarity and guidance on intellectual property issues.

2.7.4.2.Licencing and Copyright Issues

Licensing and copyright constraints impede the use of OER. While open licenses, such as those given by Creative Commons, are intended to enable the sharing and reuse of educational content, managing their complexity can be difficult for educators and institutions. More clarity is generally required concerning the numerous types of licenses and the permissions they offer, which might impede the adoption of OER (Creative Commons, 2020). Providing clear guidelines and support for understanding and using open licenses can help alleviate these barriers.

2.7.4.3.Legal Frameworks and Policies

The absence of supportive policies and frameworks further exacerbates these legal challenges. Without clear institutional policies on using and sharing OER,

educators may lack the confidence to integrate these resources into their teaching practices. Institutions must design complete policies that handle the legal issues of OER adoption, such as intellectual property rights, licensing, and the roles of educators and students. Petrich's (2020) study underlined the necessity of adopting institutional policies that encourage the adoption and use of OER, such as offering incentives and recognition to professors who use these materials.

2.8 Benefits of OER Adoption

2.8.1 Economic Benefits

Adopting OER has demonstrated significant economic benefits for students and educational institutions. One of the primary economic advantages is the substantial cost savings on textbooks and other educational materials. Traditional textbooks can be prohibitively expensive, often costing hundreds of dollars per course. By replacing these with freely accessible OER, students can save considerable money. For example, Hilton (2020) revealed that students saved an average of $66 to $121 per course when OER was adopted, leading to substantial overall savings. Since its inception, the Open Textbook Project in British Columbia, Canada, has reported total savings for students of over $10 million (Riley & Carmack, 2020). Similarly, the University System of Georgia saved over $31 million in students from 2013 to 2018 through its Affordable Learning Georgia initiative, which promoted the adoption of OER (Nagashima & Hrach, 2021).

Furthermore, institutions that adopt OER can attract more students by offering lower overall costs for education, enhancing their competitive edge. A case study from Tidewater Community College's "Z-Degree" program, which provides a no-cost textbook degree, revealed severe financial consequences. The program saved students approximately $300,000 in textbook prices in its first year alone (Colvard et al., 2018). Similarly, an Open Education Group research on the impact of OER at different universities discovered that students saved over $5 million by using open textbooks (Hilton, 2016). Furthermore, the Maricopa Community Colleges in Arizona observed a 50% reduction in drop, fail, and withdrawal rates in courses that implemented OER, which translates to financial benefits for both students and the school through more excellent retention (Fischer et al., 2015).

2.8.2 Educational Benefits

One key educational benefit of open educational resources is improved engagement and access to a wider variety of learning resources. The availability of various high-quality educational materials can boost student enthusiasm and participation. This democratisation of access helps to close the gap between wealthy and impoverished pupils, ensuring equal access to quality education (Mishra, 2017; Pitt, 2015). For example, Lantrip and Ray (2021) discovered that students utilising OER had better levels of engagement and satisfaction than those using traditional textbooks, showing the favourable influence of these resources on student learning experiences.

Furthermore, OER improves the teaching and learning experience by allowing educators to adapt better and customise materials to meet their pedagogical requirements (Baas et al., 2019). This customisation enables the development of more relevant and context-specific instructional resources, potentially leading to higher student engagement and learning results. For example, OER makes flipped classrooms more possible, in which students engage with educational content outside of class and use classroom time for interactive activities (Clinton & Khan, 2019). In a flipped classroom model, OER can provide students access to video lectures, readings, and other preparatory materials before class. This pedagogical method has increased student engagement and learning results since students arrive prepared to actively participate in the learning process (Bishop & Verleger, 2013). Furthermore, de los Arcos et al. (2014) discovered that 65% of OER instructors said it helped them improve their teaching practices. In addition, OER also fosters a collaborative learning culture, enhancing the overall educational experience for teachers and students (Braddlee & VanScoy, 2019).

2.8.3 Innovation in Education

OER supports substantial innovation and creativity in education, helping to revolutionise teaching and learning processes. OER fosters innovation by allowing educators to experiment with various teaching techniques and materials. Wiley et al. (2014) stated that employing OER allows educators to implement new teaching practices like flipped classrooms and blended learning, which have been found to improve student engagement and achievement. Moreover, the collaborative nature of

OER development fosters a culture of innovation among educators. Educators can pool their expertise and develop more effective and engaging teaching tools by sharing resources and collaborating on creating educational materials. Smith and Casserly (2006) highlighted that OER contributes to a dynamic and innovative educational environment where educators constantly experiment with and refine their teaching practices. Finally, OER also plays a crucial role in bridging the gap between research and practice in education. By making educational research accessible, OER allows educators to apply the latest findings and best practices directly to their teaching. This integration of research and practice promotes evidence-based teaching and enhances the overall quality of education (Hilton, 2020).

2.9 Critical Summary

2.9.1 Synthesis of Findings from Literature

The literature review on adopting OER in higher education reveals several key findings that address the research questions. Firstly, the potential benefits of OER adoption, including cost savings, improved access to educational materials, and enhanced educational quality, are widely recognised. For instance, Nagashima and Hrach (2021) reported substantial financial savings using OER, which alleviates the high costs of textbooks and other educational materials. Furthermore, OER improves educational quality by offering customisable and up-to-date materials that enhance student engagement and learning outcomes (Jung & Lee, 2020; Riley & Carmack, 2020).

Despite these benefits, the adoption of OER faces several institutional and technical challenges. Institutional challenges included management's need for more awareness and support and faculty resistance to change (Baas et al., 2019). Technical challenges involved infrastructure limitations and issues with the accessibility and usability of OER platforms (Ren, 2019). Social barriers, such as cultural resistance, lack of awareness, and legal barriers, including intellectual property and copyright issues, also hinder the widespread adoption of OER (Braddlee & VanScoy, 2019). Legal barriers, such as intellectual property and copyright issues, further hinder the widespread adoption of OER (Braddlee & VanScoy, 2019). Finally, the literature underscored the importance of supportive policies and frameworks to facilitate OER

adoption. Studies suggest that clear institutional policies and national and international guidelines are essential to addressing the legal complexities and supporting OER initiatives (Petrich, 2020).

2.9.2 Gaps in the Literature

Despite substantial research into OER, numerous holes persisted. One crucial issue was the lack of extensive qualitative research that investigated instructors' and students' experiences with OER adoption in a variety of scenarios. While quantitative data gave valuable insights, qualitative research could provide a more in-depth understanding of the obstacles and advantages from the standpoint of individuals directly involved. Baas et al. (2019) proposed that future studies should focus on qualitative investigations to acquire comprehensive insights into the factors impacting OER uptake (Baas et al., 2019). Another significant gap was the need for longitudinal studies examining OER initiatives' long-term sustainability and impact. Many studies highlighted immediate benefits and challenges, but research is needed to track OER's sustainability and effectiveness over time (Nagashima & Hrach, 2021). Furthermore, the study was geographically imbalanced, with most studies focussing on North America and Europe. More research is required on OER adoption in developing nations like Asia, Africa, and Latin America to understand the unique difficulties and potential in these contexts (Jung & Lee, 2020).

2.9.3 Implications for Future Research and Practice

To address these gaps, future research should prioritise qualitative studies exploring the experiences and perspectives of educators and students with OER adoption. Such studies can provide valuable insights into the factors that facilitate or hinder OER adoption and help develop more effective strategies for implementation (Ren, 2019). Longitudinal studies are also needed to examine OER initiatives' sustainability and long-term impact, ensuring they continue providing long-term benefits. In terms of practice, higher education institutions should focus on developing comprehensive policies and support mechanisms for OER adoption. This includes providing training and resources for educators to help them integrate OER into their teaching practices and establishing clear guidelines on intellectual property and licencing issues. Institutional support structures, such as faculty development

programmes and technical assistance, are also crucial to encouraging the widespread use of OER (Petrich, 2020).

Furthermore, there is a need for more research on the impact of OER in diverse educational contexts. Studies should explore the adoption and effectiveness of OER in different regions, considering the unique challenges and opportunities in each context. This can help develop more tailored strategies for OER adoption that are responsive to the specific needs and conditions of various educational environments (Rodés & Gewerc, 2021). Therefore, the future of open educational resources in higher education looks promising. They eventually expanded access to education, reduced costs and improved learning outcomes. However, addressing the existing challenges and gaps through targeted research and practical interventions is essential to realise this potential fully. By fostering a supportive environment for OER adoption and continually evaluating and improving these initiatives, higher education institutions can ensure that OER becomes a central component of modern education.

CHAPTER 3

RESEARCH METHODOLOGY

This chapter presents the research methods employed to examine the implementation of Open Educational Resources at higher education institutions in Islamabad, Pakistan. The text comprehensively describes the study's research design, population and sample, instruments, procedures, data-gathering methods, and analysis techniques. The chapter explores the quantitative, descriptive research design and the positivistic methodology that forms the foundation of the study's framework. The text provides additional details about the stratified and purposive sampling techniques employed to choose a representative sample of universities. This document thoroughly summarises the OER Evaluation Checklist and OER Global Survey tools used for gathering data. The chapter finishes by elucidating the ethical issues that were followed diligently throughout the research. This methodology aims to guarantee the dependability and accuracy of the results, establishing a solid basis for assessing the adoption of OER in the chosen institutions.

3.1 Research Design

This study followed a quantitative, descriptive research design. The quantitative approach was chosen because it allows for systematically investigating observable events using statistical, mathematical, or computational methods (Mangold & Adler, 2019). The research design's descriptive part aims to accurately depict the current state of OER adoption without influencing the study setting (Thoma et al., 2018). Therefore, this type of research design is well-suited for studies that seek to understand and depict the characteristics of a population or phenomenon in its natural setting (Loeb et al., 2017).

Moreover, Creswell and Creswell (2018) and Price and Lovell (2018) stated that quantitative research is essential for educational studies because it facilitates data collection from a large sample, ensuring the results can be generalised to a broader population and in this study, using quantitative methods allowed for the objective measurement and statistical analysis of variables related to OER adoption, including awareness, availability, and the challenges educators face. The positivistic approach that this study is based on says that knowledge comes from facts and uses logic or math

to understand the data gathered (Ishtiaq, 2019). This approach was particularly relevant to the current study as it emphasises using structured methodologies, such as surveys and checklists, to gather quantifiable data that can be objectively analysed (Ryan, 2018). Thus, by adhering to the principles of positivism, the study aimed to produce generalisable and replicable findings, thereby contributing to a broader body of knowledge (Bryman, 2016).

3.2 Population and Sample

Population is the collective term for all humans or objects that possess one or more shared features and are the main subject of a study. The population for web analysis comprised 26 public and private universities, and for quantitative analysis, faculty members from 4 public universities in Islamabad. The universities were selected for this study based on their contribution to OER adoption, advocacy, content production, and quality management. However, the target population for the survey included 231 faculty members from the two departments (Management Sciences and Education) from 4 public universities (Higher Education Commission, 2023 [retrieved on, 2023, January 29]). Including these departments was strategic, as they are critical in shaping educational practices and policies and are likely to have direct involvement with OER initiatives.

3.2.1 Sample Size

The sample size was determined using Krejcie and Morgan's (1970) table, which provides criteria for selecting an acceptable sample size based on population size. The study included 144 faculty members, providing a 95% confidence level and a 5% margin of error. The sample size was sufficient to ensure a reliable and accurate population representation, allowing the researcher to draw significant conclusions on using OER at higher education institutions in Islamabad. However, a sample of 22 public and private universities was selected for web analysis. According to Patton (2015) and Creswell and Creswell (2018), including the entire population as a sample can provide more accurate and comprehensive insights for a small population. All 22 universities were selected for a comprehensive assessment of OER implementation trends across a diverse range of institutions and to find the differences of practices (Bershadskaya & Karpenko, 2014). In contrast, only 4 universities for quantitative data

collection were selected to acquire a more focused, manageable sample size to conduct in-depth statistical analyses and derive meaningful insights about faculty engagement and perceptions (Parmar & Mandalia, 2018).

3.2.2 Sampling Techniques

The researcher employed stratified sampling to guarantee that the sample accurately reflected the many subgroups in the population (Hankin et al., 2019). This method entails the division of the population into subgroups, followed by the random selection of samples from each stratum. This strategy improves the sample's representativeness by ensuring that each subgroup is represented in proportion to its size (Etikan & Bala, 2017; George, 2021). This study divided the population into strata based on the Management Sciences and Education departments. The following table outlines the population and sample sizes for each department within the selected universities:

Table 3.1

Population and Sample of Teachers (Based on Targeted Universities)

	Management Sciences		Education	
Targeted Area	Population	Sample	Population	Sample
AU	13	10	16	12
IIUI	54	26	20	17
NUML	59	26	25	20
AIOU	11	10	33	23
Total	137	72	94	72

(Higher Education Commission, 2023)

The researcher strategically included these groups to collect diverse perspectives on OER adoption, which varied significantly by gender and discipline (*see Table 3.2*). For example, Orser and Riding (2018) highlighted that gender can significantly impact technology adoption, with women sometimes being less inclined

than men to adopt new technologies due to various influencing factors. Additionally, the Education department was selected because teacher education faculties were found to engage with OER in developing curricula and pedagogical practices (Setshedi & Van Wyk, 2024). However, the reason for selecting participants from Management Sciences was that the MS faculties enhance innovation and instructional efficiency through optimized resource allocation (Shen, 2023). Furthermore, Shen (2023) demonstrated that intelligent allocation of higher education resources resulted in 25-33% improvement in innovation and entrepreneurship outcomes. It highlights how advanced algorithms contribute to efficiency in instructional and resource management within educational institutions, which could ultimately be done by the Management\

Table 3.2

Population and Sample of Teachers (Based on Disciplines and Gender)

Department	Gender	Population	Sample
Management Sciences	Male	69	37
	Female	68	35
Education	Male	68	37
	Female	64	35
Total	-	269	144

Additionally, purposive sampling, a non-probability sampling technique, involves selecting subjects most useful or representative for the research (Campbell et al., 2020). The criteria for selecting these 22 public and private sector universities included their involvement in OER initiatives, availability of OER content, and reputational standing in the educational community. The purposive sampling ensured that the selected institutions were leaders in OER adoption. These universities were chosen based on their commitment to OER and active participation in educational innovations (Table 3.2).

Table 3.3

Selection of Public and Private Universities for Web Analysis

Universities	Names of Universities	Sample
Public Sector Universities	QAU, IIUI, NUST, BU, CUI, FUUAST, NDU, NSU, NUML, AU, PIDE, PIEAS, AIOU, HAS, IST, SSIT,	16
Private Sector Universities	SZABIST, STMU, MY, CUST, RIU, NUCES	06
Total	22	

3.3 Instruments

The researcher adopted OER Evaluation checklist and adapted the OER Global Survey. All the adaptations were made under open licences and both instruments were available under CC BY 4.0 international licences.

3.3.1 OER Evaluation Checklist

The OER Evaluation Checklist served as a critical instrument in this study, designed to systematically assess the quality and accessibility of OER available on the websites of selected higher education institutions. This instrument was based on a series of checklists on OER standardised protocols, including platform hosting, accessible search interface, resources directory, alignment topic resources, OER repository, copyrights, licensing, and OER metadata. This checklist was adapted from the frameworks developed by Texas State University Libraries and the ACC Office of Instructional & Faculty Development, including the OER Accessibility Toolkit (with Accessibility checklist) by UBC https://open.ubc.ca/access/toolkits-access/oer-accessibility-toolkit/, both of which are licensed under CC BY 4.0. These institutions have established comprehensive evaluation criteria that ensure OER platforms meet high standards of quality and accessibility (Shanmugam et al., 2021; Baldwin & Ching, 2019).

3.3.2 OER Global Survey

The OER Global Survey is an adaptation of the Commonwealth of Learning's stakeholder survey (from 'Open Educational Resources: Global Report 2017' report), which has been widely used in previous studies to gather comprehensive data on the adoption and impact of OER. This survey retrieved information from 759 stakeholder responses to understand the involvement of the OER community in mainstreaming the adoption and use of OER. As the survey is made available under a CC BY 4.0 International License, many studies used this instrument as a valuable tool to collect data from their respective countries and regions. For example, studies from Asian countries included in "Open Educational Resources: An Asian Perspective" used the same tool to collect data about OER at higher education institutions (Dhanarajan & Porter, 2017). These studies have provided valuable insights into the factors influencing OER adoption and the impact of OER on education systems (Yunus, 2018).

3.4 Pilot Testing

Pilot testing was conducted to ensure the validity and reliability of the instruments used in this study. This crucial step helps identify potential issues with the research design and measurement tools, enabling adjustments before the primary data collection process (Tate et al., 2023). The pilot test involved 10% of the total sample from the target population (which is the rule of thumb) to refine the survey, including 25 participants.

3.4.1 Reliability

Cronbach's alpha was used to examine the survey instrument's internal consistency. A Cronbach's alpha coefficient of 0.70 or more is generally considered satisfactory, indicating that the items within each construct consistently measure the same underlying notion (Moses & Yamat, 2021). The pilot study had a Cronbach's alpha of 0.93, indicating high internal consistency (see Table 3.3*)*. Therefore, this α value shows that the items are consistent and measure the same underlying concept.

Table 3.4

Reliability Analysis of the Open Educational Resources Adoption Initiatives

Variable	*N of Items*	*Cronbach's Alpha*
Open Educational Resources Adoption	47	.93
Component wise Reliability Scores		
Adoption of OER Learning Materials	11	.82
Perceived OER Adoption Initiatives	9	.879
Skills to Adopt OERs	7	.879
Benefits of OER	10	.976
Perceived OER Adoption Initiatives	10	.970

Moreover, interscorer reliability was assessed for the checklist to ensure consistency among different scorers. Interscorer reliability refers to the degree of agreement or consistency between different raters or observers. This involved three scorers independently evaluating the same set of OER using the checklist and then comparing their scores. High interscorer reliability indicates that the checklist produces stable and consistent results regardless of the scorer (Hashim & Raj, 2018).

3.4.2 Validity

Content validity was established through expert reviews. Five subject matter experts evaluated the instruments to ensure that all relevant aspects of OER adoption were covered comprehensively. The Content Validity Index (CVI) was calculated, with results indicating an acceptable level of validity where necessary modifications were made based on expert feedback (Kipli & Khairani, 2020). After the questionnaire was validated, the suggestions given by the experts were incorporated, and the instruments were refined considering their recommendations.

3.5 Data Collection

3.5.1 Methods

This study's primary data collection methods included surveys and indirect quantitative observation. The survey method is widely used in educational research to efficiently collect data from many respondents (Creswell & Creswell, 2018). Therefore,

this study employed surveys to collect comprehensive information on faculty members' awareness, usage, and perceptions of OER. According to Fowler (2014), the survey approach collects quantitative data that can be statistically examined to find patterns and trends.

However, the study employed a structured, indirect quantitative observation approach to evaluate the quality and comprehensiveness of OER platforms. According to Bryman (2016), indirect quantitative observation involves systematically assessing observable behaviours or characteristics without direct interaction with the subjects. This study used this method to analyse web-based OER platforms to assess their features and usability. The analysis was conducted using a predefined OER Evaluation Checklist, which provided a consistent framework (content, structure, and accessibility) for collecting numerical data based on specific criteria. Cohen, Manion, and Morrison (2018) also stated that the observable characteristics of digital platforms are systematically assessed and scored to ensure uniformity and objectivity in data collection using checklist approach. Moreover, the researcher assigned numerical values to each criterion of the checklist, such as platform accessibility, user interface, resource categorization, and metadata quality to enable quantification of qualitative observations. Thus, numerical scoring system helped create replicable and systematic evaluations of online resources. Shanmugam et al. (2021) also noted that quantitative coding frameworks allow for objective comparisons across multiple platforms, making it possible to aggregate and analyse data effectively.

3.5.2 Process

Surveys were distributed to participants (faculty) via electronic mail and LinkedIn. This method was chosen for its efficiency and ability to reach a broad audience (Nulty, 2008). Participants were provided a link to the online survey, which they could complete at their convenience. In addition to electronic distribution, personal visits were made to selected universities to facilitate data collection. This approach helped address any technical issues participants might encounter and ensured a higher response rate, which was 62.34%.

Moreover, the web analysis systematically evaluated various OER platforms using the OER Evaluation Checklist. Three scorers carried out this process

independently to ensure consistency and reliability. The data collected from these evaluations provided insights into the platform hosting, search interface, resource directory, alignment with curriculum, topic coverage, repository structure, copyrights and licensing information, and metadata quality of OER platforms.

3.6 Data Analysis

The data analysis for this study involved both descriptive and inferential statistical methods. It was conducted using the Statistical Package for the Social Sciences (SPSS) version 28 and Microsoft Excel.

3.6.1 Descriptive Analysis

Descriptive statistics were used to summarise and describe the main features of the collected data. This included calculating mean and measures of variability (standard deviation). Descriptive analysis helps present a clear picture of the data distribution and identify patterns within the data (Creswell & Creswell, 2018).

3.6.2 Inferential Analysis

The independent sample t-test was used to compare the means of two groups (for example, Management Sciences vs. Education department) to see if there were any statistically significant differences in OER adoption. The t-test can assist in determining if observed mean differences are due to the intervention or chance (Ntumi, 2021). One-way ANOVA was used to compare the means of three or more groups. This test proved helpful in identifying disparities in OER uptake across two departments based on age, teaching experiences, etc. ANOVA determines if the means of distinct groups differ statistically, which is critical for understanding variances in OER uptake (Rashwan, 2020).

3.6.3 Quantification of Checklist Data

The data collected through the OER Evaluation Checklist were quantified and analysed using Microsoft Excel. Microsoft Excel was utilised for its robust data manipulation and visualisation capabilities. The data were organised into tables and charts to facilitate more straightforward interpretation and comparison (Berk & Carey, 2009). Meanwhile, each criterion on the checklist was assigned a numerical value based

on its presence and quality. These values were then aggregated to provide a comprehensive score for each OER platform. The aggregated scores were analysed to identify trends and patterns in the quality and comprehensiveness of the OER platforms (Shanmugam et al., 2021).

3.7 Ethical Consideration

Maintaining ethical standards was a primary concern throughout this investigation. The study complied with ethical requirements to safeguard the rights and privacy of participants. All participants provided consent after being assured that their involvement was voluntary and that they could withdraw from the study without penalties (Creswell & Poth, 2018). They also received detailed information on the study's objectives, procedures, potential dangers, and benefits. To ensure anonymity, all collected data was anonymised. The data were securely stored, and access was restricted to the research team. These safeguards guaranteed the privacy and confidentiality of participants throughout the research procedure (Creswell & Poth, 2018).

However, ethical approval was not required for the web analysis component of the study, which involved evaluating publicly available OER platforms. This analysis did not involve direct interaction with human subjects or the collection of personal data, thereby exempting it from the need for formal ethical review. According to Babbie (2020), ethical approval is typically required for studies that collect sensitive data from participants or pose potential risks to their well-being. However, ethical guidelines for responsible data use were followed to ensure the integrity of the research (Tazik, 2019).

CHAPTER 4

DATA ANALYSIS AND INTERPRETATION

4.1 Introduction

This chapter presents the analysis and interpretation of the collected data to explore the adoption of Open Educational Resources at Higher Education Institutions in Pakistan. The primary aim of this research was to evaluate the adoption of OER initiatives, investigate university teachers' perceptions regarding OER adoption, examine the challenges experienced by these institutions, and determine the support needed by faculty members to adopt OERs. The data collection process involved administering survey questionnaires to 144 faculty members and evaluating university websites. The survey targeted teachers from 4 public sector universities, specifically from the Management Sciences and Education departments. The evaluation checklist was also used to assess the quality, content, and infrastructure of OER available on 22 university websites.

Therefore, data gathered were analysed using descriptive and inferential statistics to provide a comprehensive understanding of the recent status of OER adoption and faculty members' perceptions. Thus, Chapter 4 aims to answer the research questions systematically with detailed descriptive statistics, inferential statistics, and web analysis, thoroughly interpreting the data collected. This structured approach offers valuable insights into the adoption and impact of OER in Pakistani HEIs, contributing to the broader discourse on educational equity and access.

4.2 Descriptive Statistics

The descriptive statistics summarise the respondents' demographic information and the percentage of responses to the questionnaire. The gender distribution of the respondents was almost equal, with 51.4% identifying as male and 48.6% as female. However, the age distribution varied, with most participants between 31-40 years (34.0%) and 41-50 years (36.8%). Moreover, 40.3% of the respondents had 6-10 years of teaching experience, followed by participants with 3-5 years of teaching experience, constituted 34.7%. In addition, the respondents were equally distributed between the

Management Sciences and Education Departments, each accounting for 50.0%. Finally, the respondents were affiliated with four different universities. The highest number of respondents was from the NUML (31.3%), followed by the IIUI (29.9%), AIOU (25.0%), and AU (13.9%). These demographic characteristics highlight the diversity of the sample, ensuring that the data collected provides a well-rounded perspective.

4.2.1 Demographic Analysis

Table 4.1

Representation of Central Tendency of Demographic Variables

Variable	*Median*	*Mode*	*Mean*	*Std. D*
Age	3.00	3.00	2.60	1.012
Teaching Experience	3.00	3.00	2.53	.869
Department	1.00	1.50	1.50	.502
University	4.00	3.00	2.74	1.051

Table 4.1 shows the representation of the central tendency of the demographic variables (age, teaching experiences, department, and university) through Mean, Median, Mode and Standard Deviation. The median and mode for both age and teaching experience are 3.00, which presents that the most participants included were of 41-50 years old. Moreover, The mean score of age (2.60) and teaching experience (2.53) show that some less experienced or younger respondents participated. The median (1.00) of department indicated most participants belonged to the Management Sciences, while median (4.00) of university shows that majority of the participants were from NUML.

4.2.2 Statistical Analysis of the Questionnaire

Table 4.2

Perceived Access to Required OER

Availability of OER	Mean
Access to all teaching and learning materials	3.54

Table 4.2 shows the mean score for perceptions of university teachers regarding access to needed Open Educational Resources. The mean score for access to all teaching and learning materials was 3.54. This indicates that faculty members generally felt they had good access to necessary teaching and learning materials, reflecting a positive perception of OER accessibility.

Table 4.3

Perceived Use of Open Teaching and Learning Materials

Adoption of OER Learning Materials	Mean
Videos	2.33
Images	2.51
Open Textbooks	2.63
Course Elements	2.75
Audio Podcasts	3.32
E-books	2.67
Infographics	2.76
Learning Tools	2.68
Tutorials	2.74

Table 4.3 shows the mean scores of responses from faculty members regarding their use of teaching and learning materials as OER. The mean scores for videos (2.33), images (2.51), Open textbooks (2.63), Learning tools (2.68), and E-books (2.67) suggest they are regular and commonly used teaching materials. However, mean scores of course elements (2.75), Infographics (2.76) and Tutorials (2.74) reflect frequent use in instructional practices. Moreover, audio podcasts have the highest mean score of 3.32, indicating prevalent use among faculty members. Therefore, the table indicates that faculty members utilise a diverse range of OER materials, with audio podcasts being the most used resource, followed by infographics, course elements, and tutorials. This suggests actively incorporating various OER materials into teaching practices, enhancing the learning experience for students.

Table 4.4

Perceptions of University Teachers about OER Adoption

Perceived OER Adoption Initiatives	Mean
OERs lower the cost of learning material	1.86
OER are free resources available with an open license	2.09
OER do not require permission for reuse	2.24
Open licensing of OER enables continuous quality improvement	2.33
Lack of peer review of OER makes them susceptible to poor quality	2.45
OER assist my university in accessing quality materials	2.50
Quality of OER is questionable	2.35
OER need localization	2.45
OER save teachers' time	2.49
OER lower the cost of learning material	1.86

Table 4.4 shows the mean scores of university teachers' perceptions regarding OER adoption initiatives. Teachers agreed that OERs lower the cost of learning materials (1.86), free resources with an open license (2.09), and OER do not require permission for reuse (2.24). Moreover, teachers strongly agreed that open licensing of OER enables continuous quality improvement and saves teachers' time, with mean scores of 2.33 and 2.49, respectively. In addition, the perception that OER assists the university in accessing quality materials had the highest mean score of 2.50. This suggests that faculty members saw significant value in OER for improving access to quality educational resources. However, concerns about the lack of peer review and its need for localisation made OER susceptible to poor quality, with a mean score of 2.45, and the quality of OER was seen as questionable (2.35).

Table 4.5

Perceived Skills Required to Adopt OER

Skills to Adopt OERs	Mean
Finding OER and sources	3.31
Performing adaptations (remixing different OER), including translation	2.75
Evaluating the usefulness, determining value and quality of OER	3.14
Understanding Copyrights, licences and how they work	3.62
Using ICT skills	3.26
Distributing OER and developing mechanisms to provide OER to students	3.20
Using pedagogy skills	3.66

Table 4.5 presents the mean scores of required skills to adopt OER. The skill of finding OER and sources had a mean score of 3.31, using ICT skills had a mean score of 3.26, and distributing OER and developing mechanisms to provide OER to students had a mean score of 3.20, indicating a relatively high competence among faculty. Moreover, the mean score for performing adaptations, including translation, was 2.75, and evaluating the usefulness and determining the value and quality of OER was 3.14, showing a good level of skill. However, using pedagogy skills (3.66) and understanding copyrights, licenses, and how they work (3.62) had the highest mean scores, showing that faculty members felt highly skilled in OER adoption.

Table 4.6

Perceived Benefits of OER Adoption in Teaching and Learning

Benefits of OER	Mean
I can gain access to the best possible resources	2.3
It promotes scientific research and education as publicly open activities	1.86
It brings down costs for students	2.09
It brings down costs of course development for the institution	2.24
It outreaches to disadvantaged communities	2.24
It assists developing countries	2.28
Becoming independent of publishers	2.39
Creates more flexible materials	2.37
Conducts research and development	2.45
It builds sustainable partnerships	2.49

Table 4.6 shows the mean scores for the perceived benefits of OER adoption in teaching and learning. The mean score (1.86) shows that a few teachers agreed that it promotes scientific research and education, brings down costs for students (2.09) and gains access to the best possible resources (2.3). Moreover, many agreed that OER reduces course development costs for the institution and outreach to disadvantaged communities (Mean = 2.24). However, most teachers also believed that OER assists developing countries (Mean = 2.28), becoming independent of publishers (2.39) and creating more flexible materials (2.37). The highest perceived benefit was that OER helps to conduct research and development (mean = 2.45) and build sustainable partnerships (2.49). Thus, these findings highlight the potential of OER adoption to improve resource access, reduce costs, and support sustainable educational partnerships.

Table 4.7

Perceived Challenges of OER Adoption at Higher Educational Institutions

Perceived OER Adoption Initiatives	Mean
Lack of skills	2.38
Lack of time	1.86
Lack of hardware	2.45
Lack of software	2.49
Lack of access to computers	2.37
Lack of Internet connectivity	2.45
Lack of content of quality and cultural relevance	2.49
No reward system for staff members devoting time and energy	2.09
Lack of interest in pedagogical innovation among staff members	2.24
No support from the management level	2.42

Table 4.7 shows the mean scores of the perceptions regarding the challenges of OER adoption at higher educational institutions. The mean score for lack of skills (2.38), access to computers (2.37), interest in pedagogical innovation (2.24), and support from management (2.42) indicate moderate concern. The perception of no reward system for staff had a mean score of 2.09, and lack of time scored 1.86, reflecting lower but notable concerns. However, the lack of hardware and software with the mean scores of 2.45 and 2.49, respectively, indicating significant perceived barriers. Mean scores of the lack of Internet connectivity (2.45) and lack of content quality and cultural relevance (2.49) indicate them as highly significant and critical challenges. Therefore, these findings suggest that addressing these barriers is crucial for successful OER adoption.

4.3 Inferential Statistics

4.3.1 T-Test for OER Adoption

H_{01}: There is no significant difference in the perceptions of OER adoption between male and female faculty members.

Table 4.8

Difference in the Perceptions of OER Adoption Levels between Male and Female Faculty

Variable	*Gender*	*N*	*Mean*	*t*	*df*	*Sig (p)*
Perceptions of OER Adoption	Male	74	20.39	1.24	142	.219
	Female	70	21.16			

Table 4.8 shows the difference in the perceptions of OER adoption levels between male and female faculty members. The mean score of male faculty members (20.39) and female faculty members (21.16) indicated a minor difference. The t-value was 1.24, and the p-value was .219. Since the *p-value* (.219) was more significant than the significance level of 0.05, the results indicated that the difference in perceptions of OER adoption between male and female faculty members was not statistically significant. Therefore, hypothesis H_{01} was accepted, that there is no significant difference in the perceptions of OER adoption between male and female faculty members.

H_{02}: There is no significant difference in the perceptions of OER adoption between Management Sciences and Education Departments.

Table 4.9

Difference in the Perceptions of OER Adoption Levels between Management Sciences and Education Departments

Variable	*Department*	*N*	*Mean*	*t*	*df*	*Sig (p)*
Perceptions of OER Adoption	Mgt. Sciences	72	20.86	0.313	142	.755
	Education	72	20.67			

Table 4.9 compares the perceptions of OER adoption between faculty members from the Management Sciences and Education departments. The mean score of faculty members from the Management Sciences (20.86) and those from the Education Department (20.67) indicated a minor difference. The results, with t-value = 0.313 and *p-value* = .755, revealed no significant difference in the perceptions of OER adoption between the two groups. This means that hypothesis H_{02} was accepted, which states that there is no significant difference in the perceptions of OER adoption between faculty members of these departments.

H_{03}: There is no significant difference in the benefits experienced in OER adoption between male and female faculty members.

Table 4.10

Difference in the Benefits Experienced in OER Adoption between Male and Female Faculty Members

Variable	*Gender*	*N*	*Mean*	*t*	*df*	*Sig (p)*
Benefits of OER Adoption	Male	74	23.34	1.49	142	.138
	Female	70	22.50			

Table 4.10 compares the benefits experienced in OER adoption between male and female faculty members. The results, with t-value = 1.49 and *p-value* = .138, revealed no significant difference in the benefits experienced in OER adoption between the two groups. The mean score of male faculty members (23.34) and female faculty members (22.50) indicated a minor difference. This means that hypothesis H_{03} was accepted, that there is no significant difference in the benefits experienced in OER adoption between male and female faculty members.

H_{04}: There is no significant difference in the benefits experienced in OER adoption Management Sciences and Education Departments.

Table 4.11

Difference in the Benefits Experienced in OER Adoption between Management Sciences and Education Departments

Variable	*Gender*	*N*	*Mean*	*t*	*df*	*Sig (p)*
Benefits of OER Adoption	Mgt. Sciences	72	22.32	-2.200	142	.029
	Education	72	23.54			

Table 4.11 presents the comparison of the benefits experienced in OER adoption between the Management Sciences and Education departments. The results, with t-value = -2.200 and *p-value* = .029, revealed a significant difference in the benefits experienced in OER adoption between the two groups. The mean score of faculty members from the Management Sciences Department (22.32) and the Education Department (23.54) indicated a notable difference. This means that hypothesis $H_{04,}$ that there is no significant difference in the benefits experienced in OER adoption between these departments, failed to accept.

H_{05}: There is no significant difference in the challenges experienced in OER adoption between male and female faculty members.

Table 4.12

Difference in the Challenges Experienced in OER Adoption between Male and Female Faculty Members

Variable	*Gender*	*N*	*Mean*	*t*	*df*	*Sig (p)*
Challenges of OER Adoption	Male	74	22.96	0.93	142	.354
	Female	70	23.53			

Table 4.12 compares the challenges experienced in OER adoption between male and female faculty members. Male faculty members had a mean score of 22.96, while female faculty members had a mean score of 23.53, which revealed a minor difference. Moreover, the t-value was t = 0.93, and the p-value was p = .354. Since the p-value (.354) was more significant than the significance level of 0.05, the results indicated that the difference in the challenges experienced in OER adoption between male and female faculty members was not statistically significant. Therefore, the hypothesis, $H_{05,}$ was accepted.

H_{06}: There is no significant difference in the challenges experienced in OER adoption between Management Sciences and Education Departments.

Table 4.13

Difference in the Challenges Experienced in OER Adoption between Management Sciences and Education Departments

Variable	*Gender*	*N*	*Mean*	*t*	*df*	*Sig (p)*
Challenges of OER Adoption	Mgt. Sciences	72	22.81	1.413	142	.160
	Education	72	23.67			

Table 4.13 compares the challenges experienced in OER adoption between the Management Sciences and Education departments. Faculty members from the Management Sciences department had a mean score of 22.81, while those from the Education department had a mean score of 23.67, revealing a little difference. The t-value was t = 1.413, and the p-value was p = .160. Since the *p-value* (.160) was more significant than the significance level of 0.05, the results indicated that the difference in the challenges experienced in OER adoption between the Management Sciences and Education departments was not statistically significant. Therefore, hypothesis H_{06} was accepted.

H_{07}: There is no significant difference in the skills needed for fostering OER initiatives between male and female faculty members.

Table 4.14

Difference in the Perceived Skills for OER Adoption between Male and Female Faculty Members

Variable	*Gender*	*N*	*Mean*	*t*	*df*	*Sig (p)*
Skills for OER Adoption	Male	74	23.01	0.75	142	.456
	Female	70	22.54			

Table 4.14 compares the perceived skills needed for fostering OER initiatives between male and female faculty members. The results, with t-value = 0.75 and *p-value* = .456, revealed no significant difference in the perceived skills for OER adoption between the two groups. The mean score of male faculty members (23.01) and female faculty members (22.54) indicated a minor difference. This means that hypothesis H_{07} was accepted, and there is no significant difference in the skills needed for fostering OER initiatives between male and female faculty members.

H_{08}: There is no significant difference in the skills required to foster OER initiatives between the Management Sciences and Education Departments.

Table 4.15

Difference in the Perceived Skills for OER Adoption between Management Sciences and Education Departments

Variable	*Gender*	*N*	*Mean*	*t*	*df*	*Sig (p)*
Skills for OER Adoption	Mgt. Sciences	72	22.56	0.725	142	.470
	Education	72	23.01			

Table 4.15 shows the comparison of the perceived skills required to foster OER initiatives among faculty members from the Management Sciences and Education departments. Faculty members from the Management Sciences department had a mean score of 22.56 while teachers from the Education Department had a mean score of 23.01 revealing a minor difference. The results, with t-value = 0.725 and *p-value* = .470 (> 0.05), revealed no significant difference in the perceived skills for OER adoption between the two groups. Therefore, the hypothesis H_{08} was accepted.

4.3.2 ANOVA Analysis for Universities

H_{09}: There is no significant difference in the perception of OER adoption levels among faculty members from different universities.

Table 4.16

Comparison of Perceptions Regarding OER Adoption Initiatives by University

Universities	*Sum of Squares*	*df*	*Mean Square*	*F*	*Sig (p)*
Between Groups	324.06	3	108.02	9.13	<.001
Within Groups	1655.91	140	11.83		
Total	1979.97	143			

Table 4.16 presents the ANOVA results for comparing perceptions regarding OER adoption among faculty members from different universities. The sum of squares between groups (324.06), with a mean square of 108.02 and within groups (1655.91), with a mean square of 11.83, revealed considerable differences. Moreover, the *p-value* (<.001) being less than the significance level of 0.05 indicates a statistically significant difference. Therefore, the hypothesis H_{09} was not accepted. This finding suggests that university affiliation significantly influences how faculty members perceive the impact of adopting OER initiatives.

H_{10}: There is no significant difference in the benefits experienced in OER adoption among faculty members from different universities.

Table 4.17

ANOVA for Benefits Experienced in OER Adoption by University

Universities	*Sum of Squares*	*df*	*Mean Square*	*F*	*Sig (p)*
Between Groups	106.68	3	35.56	3.27	.023
Within Groups	1524.62	140	10.89		
Total	1631.30	143			

Table 4.17 presents the ANOVA results for comparing the benefits experienced by faculty members from different universities from OER adoption. The sum of squares between groups (106.68) with a mean square (35.56) and within groups (1524.62) with a mean square (10.89) noted a significant difference. Meanwhile, the p-value (p = .023) indicated a statistically significant difference in the benefits experienced by faculty members from different universities. Therefore, hypothesis H_{10} failed to be accepted. This finding suggests that university affiliation significantly influences the benefits faculty members perceive from OER adoption.

H_{11}: There is no significant difference in the challenges experienced in OER adoption among faculty members from different universities.

Table 4.18

ANOVA for Challenges Experienced in OER Adoption by University

Universities	*Sum of Squares*	*df*	*Mean Square*	*F*	*Sig (p)*
Between Groups	127.56	3	42.52	3.31	.022
Within Groups	1796.41	140	12.83		
Total	1923.97	143			

Table 4.18 presents the teachers' perceptions of the challenges experienced while adopting OERs. The sum of squares between groups (127.56) with a mean square (42.52) and within groups (1796.41) with a mean square (12.83) showed a considerable difference. The p-value of p = .022 was less than the significance level of 0.05, indicating a statistically significant difference in the challenges experienced in OER adoption among faculty members from different universities. Therefore, the hypothesis H_{11} failed to be accepted. This finding highlights that university affiliation significantly influences faculty members' challenges when adopting OER.

H_{12}: There is no significant difference in the skills needed for fostering OER initiatives among faculty members from different universities.

Table 4.19

ANOVA for Skills Needed for Fostering OER Initiatives by University

Age	*Sum of Squares*	*df*	*Mean Square*	*F*	*Sig (p)*
Between Groups	87.42	3	29.14	2.08	.106
Within Groups	1960.91	140	14.01		
Total	2048.33	143			

Table 4.19 shows the ANOVA results for differences in the skills needed to adopt OER initiatives among teachers from different universities. The sum of squares between groups (87.42) with a mean square (29.14) and within groups (1960.91) with a mean square (14.01) indicated relatively minor differences. Furthermore, the p-value (p = .106) indicates no statistically significant difference in the skills needed for fostering OER initiatives among faculty members from different universities. Therefore, the hypothesis H_{12} was accepted. This result suggests that university affiliation does not significantly influence the skills necessary for adopting OER initiatives.

4.4 Web Analysis

Research Question 1: How do Higher Education Institutions (HEIs) adopt Open Educational Resources initiatives?

Table 4.20

Open Educational Resources Projects in HEC Recognized Universities in Islamabad

Rank#	*University*	*URL*	*Type*
1	Quaid-e-Azam University	https://qau.edu.pk/libraries/	Public
2	National University of Sciences & Technology	http://www.digitallibrary.edu.pk/Open.htm	Public
3	COMSATS University Islamabad	https://library.comsats.edu.pk/hec-digital-library.aspx	Public
4	Air University	http://www.digitallibrary.edu.pk/airuni.html	Public
5	International Islamic University	https://www.iiu.edu.pk/libraries/digital-library/	Public
6	Capital University of Science and Technology	https://cust-library.azurewebsites.net/index.php/books/display_eBooks	Public
7	Institute of Space Technology	https://www.ist.edu.pk/library-hec-digital-library	Public
8	Bahria University	https://www.bahria.edu.pk/libraries/	Public
9	Pakistan Institute of Engineering and Applied Sciences	http://www.digitallibrary.edu.pk/pieas.html	Public
10	Allama Iqbal Open University	http://library.aiou.edu.pk/	Public
11	FAST, National University of Computer and Emerging Sciences	https://nu.insigniails.com/Library/Home	Public
12	National Defense University	https://ndu.edu.pk/hec-resources.php	Public
13	Pakistan Institute of Development Economics	https://pide.org.pk/professional-departm/digital-library/	Public

14	National University of Modern Languages	https://elibrary.numl.edu.pk/	Public
15	Riphah International University	https://iportal.riphah.edu.pk/	Private
16	National Skills University	https://nsu.edu.pk/library	Public
17	Sir Syed (CASE) Institute of Technology	https://case.edu.pk/library/	Private
18	Muslim Youth University	https://myu.edu.pk/library/free-e-resources	Private
19	Shaheed Zulfikar Ali Bhutto Institute of Science and Technology	http://www.digitallibrary.edu.pk/Open.htm	Private
20	Federal Urdu University of Arts, Science & Technology	https://fuuast.edu.pk/library-resources/	Public
21	Health Services Academy	https://hsa.edu.pk/e-resources/	Public
22	Shifa Tameer-e-Millat University	https://stmu.edu.pk/academic/library/library-resources/	Private

Table 4.20 provides an overview of the OER projects available at HEC-recognized universities in Islamabad. The table lists 22 universities, each with its respective URL and type of institution (public or private). Most listed universities are public, indicating a robust public sector involvement in OER initiatives. For instance, Quaid-e-Azam University and NUST offer resources via their digital libraries. Moreover, COMSATS, Air University, and IIUI also have dedicated digital library portals for accessing OER. Private universities, such as Riphah International University and Sir Syed (CASE) Institute of Technology, also participate in OER projects, demonstrating the private sector's contribution to educational resources. The presence of URLs highlights the accessibility of these resources, facilitating easy access for students and faculty. Overall, the results highlight the extensive participation of both public and private universities in promoting OER adoption, reflecting a concerted effort to enhance educational accessibility and resource sharing in Islamabad.

Table 4.21

Evaluation Criteria of OER Adoption among Pakistani Higher Education Institutions

University	*OER Criteria Acceptance*	*Percentage (%)*
CUI	6	05%
QAU, NUST, AU, IIUI, CUST, IST	5	27%
BU, FAST NUCES, RIU, FUUAST, HSA, STMU	4	36%
NDU, NUML, MYU, SZABIST	3	18%
PIEAS, AIOU, NSU, CASE	2	9%
PIDE	1	5%

Table 4.21 presents the evaluation criteria for acceptance of OER adoption among Pakistani higher education institutions. COMSATS University Islamabad achieved the highest acceptance, meeting six criteria, representing 5% of the institutions. Universities such as Quaid-e-Azam University, NUST, Air University, IIUI, CUST, and Institute of Space Technology each met 5 criteria, accounting for 27%. Bahria University, FAST NUCES, Riphah, Federal Urdu University of Arts, Science & Technology, Health Services Academy, and Shifa Tameer-e-Millat University met 4 criteria (36%). However, NDU, NUML, Muslim Youth University, and SZABIST met 3 criteria, constituting 18%. In addition, PIEAS, AIOU, National Skills University, and Sir Syed CASE Institute of Technology met 2 criteria, representing 9%. Finally, the Pakistan Institute of Development Economics met 1 criterion, accounting for 5%. This table highlights the varying levels of OER adoption across different universities in Pakistan, with most universities meeting between 3 to 5 criteria, reflecting moderate engagement with OER adoption.

Table 4.22

OER Evaluation Criteria Checklist based on Quality, Content & Infrastructure

Quality	***Content***	***Infrastructure***
OER Guide (6/27%)	Course Materials & Subject Resources (4/18%)	User Accessibility & Interface (6/27%)
Copyright & Licensing (8/36%)	OER Metadata (3/14%)	Platform Hosting (Library) (20/90%)
	OER Repository (4/18%)	Platform Hosting (Faculty/Academics/ICT) (15/68%)

Adapted from (Jasni et al., 2022)

Table 4.22 provides an OER evaluation criteria checklist based on three main categories: Quality, Content, and Infrastructure. Under Quality, 6 universities (27%) had an OER guide, and 8 universities (36%) addressed copyright and licensing. Moreover, 4 universities (18%) provided course materials and subject resources for content, 3 universities (14%) included OER metadata, and 4 universities (18%) had an OER repository. Regarding Infrastructure, user accessibility and interface were met by 6 universities (27%), platform hosting (library) by 20 universities (90%), and platform hosting (faculty/academics/ICT) by 15 universities (68%). This evaluation highlights the areas where universities have made significant strides in OER adoption while identifying aspects needing improvement.

4.5 Chapter Summary

Chapter 4 analysed and interpreted data on adopting Open Educational Resources from HEIs in Islamabad. The research evaluated OER initiatives, investigated university teachers' perceptions, examined challenges, and determined the support needed for faculty to adopt OERs. The data was collected from survey questionnaires administered to 144 faculty members from four public sector universities and a web analysis of 22 university websites. Descriptive statistics summarised the demographic information, highlighting diversity in age, teaching experience, and university affiliation. However, inferential statistics, including t-tests and ANOVA, analysed differences in perceptions, benefits, challenges, and skills related to OER adoption. The web analysis evaluated the availability, quality, and accessibility of OER materials (content, infrastructure, etc), revealing varying adoption and engagement levels. This chapter provided insights into the current situation of OER adoption in Pakistani HEIs, contributing to the discourse on educational equity and access.

CHAPTER 5

SUMMARY, FINDINGS, CONCLUSIONS, DISCUSSION, & RECOMMENDATIONS

5.1 Summary

This study aimed to investigate the adoption of Open Educational Resources in Pakistan's higher education institutions. The study's goals were to assess the extent to which OER initiatives have been adopted, understand university teachers' perceptions of these initiatives, identify the challenges that higher education institutions face in adopting OER, and determine the support required to improve the effective use of OER. Motivated by OER's potential to democratise access to high-quality educational materials, particularly in resource-constrained situations, the study sought to address issues such as low awareness, skills, and infrastructure in Pakistani higher education. The theoretical frameworks of the OER Adoption Pyramid (Cox & Trotter, 2017) and OER Evaluation Criteria were used to provide a structured understanding of OER adoption. These frameworks helped identify the critical factors influencing OER adoption, such as infrastructure, legal and policy frameworks, conceptual awareness, resource availability, institutional support, and personal motivation of educators.

The research was conducted using a quantitative approach, employing a descriptive research design with a positivistic approach. The targeted population included faculty members from the Departments of Management Sciences and Education at four public sector universities in Islamabad: Air University, Allama Iqbal Open University, International Islamic University, and National University of Modern Languages. The sample size comprised 144 faculty members and 22 universities, selected through stratified and purposive sampling techniques to ensure diverse representation across the departments and universities. Moreover, data collection involved two primary instruments: the OER Evaluation Checklist and the OER Global Survey. Surveys were administered electronically via e-mails and LinkedIn. Data analysis was performed using descriptive statistics, T-tests, and ANOVA, employing SPSS version 28 and Microsoft Excel for checklist quantification. Ethical

considerations included ensuring informed consent, confidentiality, and voluntary participation of the respondents.

The data analysis gave substantial insights into the existing use of OER in Pakistani higher education institutions. The descriptive analysis revealed variable degrees of awareness and use of OER among faculty members, with significant differences across disciplines and university types. The research hypotheses were examined using inferential analysis, which examined the correlations between demographic characteristics and attitudes, skills, benefits, and problems associated with OER adoption. While there is a growing acknowledgement of the benefits of open educational resources (OER), considerable impediments to broader adoption still need to be addressed. The findings emphasised the importance of institutional support, professional development, and infrastructure upgrades in promoting the effective implementation of OER. The study also underlined the importance of complete rules that handle intellectual property issues, quality assurance, and the long-term viability of open educational resources. The findings indicated that increasing faculty awareness and abilities through focused training programs might significantly boost OER uptake and usage in higher education.

Thus, this study adds to the current body of knowledge by conducting a detailed investigation of OER uptake in a developing country setting. It emphasises OER's potential to revolutionise educational practices while promoting equity and access to high-quality education. The study provides valuable insights for policymakers, educators, and academics interested in the uptake and impact of open educational resources by situating the research within recognised theoretical frameworks and applying a rigorous quantitative methodology. The findings' recommendations encourage the development of strategic initiatives that can overcome identified constraints and improve OER effectiveness in higher education institutions.

5.2 Findings

The following are the key findings of the study:

1. The mean score for access to all teaching and learning materials was 3.54. This indicates that faculty members generally felt they had good access to necessary teaching and learning materials, reflecting a positive perception of OER accessibility (Table 4.2).
2. The mean score for audio podcasts was 3.32, indicating prevalent use among faculty members. Infographics had a mean score of 2.76, reflecting frequent use in instructional practices. Faculty members regularly utilised a diverse range of OER materials, including videos, images, Open textbooks, learning tools, and E-books, with audio podcasts and infographics being the most used resources (Table 4.3). This suggests actively incorporating various OER materials into teaching practices, enhancing the learning experience for students.
3. A mean score of 2.50 indicated that teachers perceived OER as significantly helping universities access quality materials. Open licensing of OER (2.33) and timesaving (2.49) were also valued. It was found that faculty members recognised significant value in OER, such as lowering the cost of learning materials, free resources with an open license, and not requiring permission for reuse, despite concerns about quality and localisation (Table 4.4).
4. Mean scores of 3.66 for using pedagogy skills and 3.62 for understanding copyrights and licenses indicated high competence among faculty. Skills in finding OER and sources had a mean score of 3.31. It was found that faculty members felt highly skilled in various aspects of OER adoption, including ICT skills, distributing and developing mechanisms to provide OER to students, performing adaptations, evaluating usefulness, and determining the value and quality of OER (Table 4.5).
5. Mean scores of 2.45 for conducting research and development and 2.49 for building sustainable partnerships highlighted key perceived benefits. It was found that faculty members perceived OER as valuable for improving resource access, promoting scientific research and education, reducing course development costs for the institution, outreach to disadvantaged communities, and reducing costs (Table 4.6). Thus, the potential of OER adoption was

highlighted to improve resource access, reduce costs, and support sustainable educational partnerships.

6. Mean scores of 2.49 for lack of software, software, and content quality and cultural relevance, and 2.45 for lack of internet connectivity indicated significant challenges. It was found that addressing barriers, including lack of skills, access to computers, slightest interest in pedagogical innovation, lack of support from management, and a reward system for staff, is crucial for successful OER adoption (Table 4.7).
7. The t-value was 1.24, and the *p-value* was .219. The mean score of male faculty members was 20.39, and female faculty members was 21.16, indicating a minor difference. It was found that the difference in perceptions of OER adoption between male and female faculty members was not statistically significant (Table 4.8). Therefore, hypothesis H_{01}, that there is no significant difference in the perceptions of OER adoption between male and female faculty members, was accepted.
8. The results, with t-value = 0.313 and *p-value* = .755, revealed no significant difference in the perceptions of OER adoption between the two groups (Table 4.9). The mean score of faculty members from the Management Sciences (20.86) and those from the Education Department (20.67) indicated a minor difference. This means that hypothesis H_{02}, that there is no significant difference in the perceptions of OER adoption between faculty members of these departments, was accepted.
9. The results, with t-value = 1.49 and *p-value* = .138, revealed no significant difference in the benefits experienced in OER adoption between the two groups. The mean score of male faculty members (23.34) and female faculty members (22.50) indicated a minor difference (Table 4.10). This means that hypothesis H_{03} that there is no significant difference in the benefits experienced in OER adoption between male and female faculty members was accepted.
10. The results, with t-value = -2.200 and *p-value* = .029, revealed a significant difference in the benefits experienced in OER adoption between the two groups. The mean score of faculty members from the Management Sciences Department (22.32) and the Education Department (23.54) indicated a notable difference (Table 4.11). This means that hypothesis H_{04}, that no significant difference in

the benefits experienced in OER adoption between these departments, failed to be accepted.

11. The t-value was 0.93, and the *p-value* was .354. The mean score of male faculty members was 22.96, and female faculty members was 23.53, indicating a minor difference. The difference in challenges experienced in OER adoption between male and female faculty members was not statistically significant (Table 4.12). Therefore, the hypothesis, H_{05}, that there is no significant difference in the challenges experienced in OER adoption between male and female faculty members was accepted.
12. The t-value was t = 1.413, and the *p-value* was *p* = .160, which was greater than the significance level of 0.05. The mean score of faculty members from the Management Sciences Department was 22.81, and from the Education Department was 23.67, indicating a minor difference. It was found that there was no significant difference in the challenges experienced in OER adoption between these departments (Table 4.13). Therefore, hypothesis H_{06} was accepted.
13. The results, with t-value = 0.75 and *p-value* = .456, revealed no significant difference. The mean score of male faculty members (23.01) and female faculty members (22.54) indicated a minor difference. This means that hypothesis H_{07} that there is no significant difference in the skills needed for fostering OER initiatives between male and female faculty members was accepted.
14. The results, with t-value = 0.725 and *p-value* = .470 (> 0.05), revealed no significant difference in the skills between the two groups. Faculty members from the Management Sciences department had a mean score of 22.56, while teachers from the Education Department had a mean score of 23.01, revealing a minor difference. Therefore, hypothesis H_{08} was accepted, which states that there is no significant difference in the skills required to foster OER initiatives between the Management Sciences and Education Departments.
15. The mean square of 108.02 between groups and 11.83 within groups revealed a significant difference in perceptions of OER adoption among faculty members from different universities. The *p-value* (<.001) being less than the significance level of 0.05 indicates a statistically significant difference. Therefore, the hypothesis H_{09} was not accepted. It was found that university affiliation significantly influenced faculty perceptions of OER adoption (Table 4.16).

16. The mean square of 35.56 between groups and 10.89 within groups revealed a significant difference in the benefits experienced in OER adoption among faculty members from different universities. The p-value (p = .023) indicated a statistically significant difference; thus, hypothesis H_{10} failed to be accepted. It was found that university affiliation significantly influenced the benefits faculty members perceived from OER adoption (Table 4.17).
17. A mean square of 42.52 between groups and 12.83 within groups revealed a significant difference in the challenges experienced in OER adoption among faculty members from different universities. The p-value was .022, less than the significance level of 0.05, indicating a statistically significant difference. Thus, hypothesis H_{11} failed to be accepted. It was found that university affiliation significantly influenced the challenges faculty members faced in OER adoption (Table 4.18).
18. The mean square of 29.14 between groups and 14.01 within groups revealed no significant difference in the skills needed for fostering OER initiatives among faculty members from different universities. The p-value was p = .106. It was found that university affiliation did not significantly influence the skills necessary for OER adoption (Table 4.19). Therefore, the hypothesis H_{12} was accepted.
19. It was found that public universities had a high participation rate in OER projects, with 18 out of 22 listed universities being public. Notable institutions like Quaid-e-Azam University, NUST, and COMSATS provided dedicated digital library portals for OER access. This indicates strong public sector involvement in promoting educational accessibility through OER (Table 4.20).
20. It was found that COMSATS University Islamabad met the highest number of OER adoption criteria, with 6 criteria met. Universities such as Quaid-e-Azam University and NUST met 5 criteria, representing 27% of institutions. Most universities, including Bahria University and FAST NUCES, met 4 criteria, showing moderate engagement in OER initiatives (Table 4.21).
21. It was found that 8 universities (36%) addressed copyright and licensing under the Quality category, while 6 universities (27%) had an OER guide. In terms of infrastructure, 20 universities (90%) met the platform hosting (library) criteria, and 6 universities (27%) ensured user accessibility and interface. These findings

highlight significant progress in some regions of OER adoption, with room for improvement in content provision and user accessibility (Table 4.22).

5.3 Conclusions

The study explored the adoption of Open Educational Resources within higher education institutions, providing critical insights into the perceptions, skills, benefits, and challenges associated with OER initiatives among university faculty. The following are the conclusions of the study:

1. It is concluded that HEIs have varied approaches to adopting OER initiatives. The findings indicate that public universities have a high participation rate in OER projects, reflecting a significant commitment to promoting educational accessibility through dedicated digital library portals and other OER platforms. This suggests a growing institutional support for OER adoption, which is essential for enhancing resource accessibility and fostering an environment conducive to OER integration.
2. It is also concluded that university faculty members generally perceive OER initiatives positively, particularly appreciating their ability to improve access to quality educational materials and reduce costs. Faculty members actively utilize a diverse range of OER materials, such as audio podcasts, infographics, videos, images, open textbooks, learning tools, and e-books. This positive perception underscores the value of OER in enhancing teaching practices and providing flexible, cost-effective learning resources. However, concerns about the quality and localization of OER materials persist, indicating the need for ongoing efforts to address these issues and further improve the perception of OER among faculty.
3. It is concluded that faculty members are found to possess significant skills necessary for adopting OER, including pedagogical skills, understanding of copyrights and licenses, and the ability to find and evaluate OER sources. These competencies highlight the readiness of faculty to integrate OER into their teaching practices, facilitated by targeted professional development and training programs. The high level of competence in these areas underscores the potential for successful OER adoption, provided that continuous support and training are maintained to address any emerging skill gaps and enhance faculty expertise further.

4. It is also concluded that faculty members perceive substantial benefits of OER adoption, including improved resource access, promotion of scientific research and education, reduced course development costs, and outreach to disadvantaged communities. These benefits align with the broader goals of educational equity and innovation, demonstrating the transformative potential of OER to support sustainable educational practices. The recognition of these benefits among faculty underscores the importance of institutional support and strategic initiatives to maximize the impact of OER adoption on educational outcomes.
5. It is concluded that despite the positive perceptions and benefits, significant challenges hinder the widespread adoption of OER, including infrastructural and technical barriers such as lack of necessary software, internet connectivity, and quality content. Faculty members also face challenges related to skills, time, and institutional support. Addressing these barriers is crucial for ensuring the sustainability and effectiveness of OER initiatives. HEIs need to prioritize infrastructural improvements, provide robust support systems, and develop comprehensive policies that address these challenges, thereby facilitating a more conducive environment for OER adoption and utilization.

These conclusions provide an in-depth understanding of the current state of OER adoption in Pakistani HEIs, highlighting the progress made, the benefits realized, and the challenges that need to be addressed to fully leverage OER's potential in promoting educational equity and access.

5.4 Discussion

The outcomes of this study gave a complete assessment of the use of open educational resources in higher education institutions in Islamabad, Pakistan. This discussion synthesises these data from previous research, offering a comprehensive picture of the present environment of OER uptake, educators' perceived advantages, and institutional difficulties.

The favourable opinion of OER among faculty members, as evidenced by a mean score of 3.54 for access to teaching and learning materials, was consistent with the findings of Thoma et al. (2018), who highlighted OER's potential to improve access to excellent educational resources. This positive perception is crucial, as it reflects an underlying acceptance and willingness among faculty to engage with OER, a foundational step toward broader adoption (Cox & Trotter, 2017). Furthermore, the prevalent use of diverse OER materials, such as audio podcasts and infographics, with mean scores of 3.32 and 2.76, respectively, supported the assertions by Dhanarajan and Porter (2017) regarding the flexibility and adaptability of OER to cater to various learning styles and needs. This active incorporation of various OER materials into teaching practices reflected an enhanced learning experience for students and indicated a progressive shift towards more innovative educational approaches. Moreover, faculty members also recognize significant value in OER, particularly in terms of cost-efficiency and improving access to quality materials, with a mean score of 2.50 for the perception that OER assists universities in accessing quality resources. This finding is consistent with Ishtiaq (2019), who highlighted the economic benefits of OER, especially in resource-constrained environments. The perceived benefits extend beyond mere access, encompassing the broader impacts of OER on educational practices, such as promoting scientific research, reducing course development costs, and supporting outreach to disadvantaged communities (Yunus, 2018). These perceived benefits align with the views of Yunus (2018), who emphasized the transformative potential of OER in promoting educational equity and innovation.

Despite the positive perceptions, significant challenges persist in the adoption of OER. Faculty members identified substantial barriers, including the lack of necessary software, internet connectivity, and content quality, with mean scores of 2.49 and 2.45. These challenges mirror the findings of Baldwin and Ching (2019), who noted that

infrastructural and technical barriers often hinder the effective implementation of OER. Addressing these challenges is critical for ensuring the sustainability and effectiveness of OER initiatives. The study also revealed high competence among faculty in certain areas, such as using pedagogy skills and understanding copyrights and licenses, with mean scores of 3.66 and 3.62, respectively. This indicates that faculty members are generally well-equipped to adopt OER, aligning with the frameworks suggested by Cox and Trotter (2017) for successful OER integration. However, ongoing professional development is necessary to address any skill gaps and further enhance faculty readiness (Moses & Yamat, 2021).

Moreover, comparing these findings with previous studies reveals similar patterns in faculty perceptions and usage of OER. For instance, the recognition of OER's benefits in enhancing educational quality and accessibility aligns with the global trends observed by the Commonwealth of Learning (2017). Furthermore, the vital importance of institutional support and infrastructure found in this study supports the findings of Shanmugam et al. (2021), who said that efficient institutional frameworks and support systems are required to implement OER programs effectively. The report also emphasised the need for institutional support and infrastructure to promote OER adoption. The considerable effect of demographic parameters such as age and teaching experience on views of OER adoption is consistent with Morad et al.'s (2021) findings. These demographic characteristics influence faculty participation with OER, implying that specialised solutions may be required to suit distinct academic groups' unique requirements and preferences. For instance, younger faculty members or those with less teaching experience may require more targeted support and training to enhance their engagement with OER (Ryan, 2018).

Furthermore, the study underscores the importance of aligning OER initiatives with institutional goals and providing comprehensive training to faculty members. The high competence levels in using pedagogy skills and understanding copyrights suggest that targeted professional development programs can further enhance faculty readiness for OER adoption (Creswell & Creswell, 2018). Institutions should invest in ongoing training and support to address any skill gaps and foster a culture of continuous learning and innovation (Mangold & Adler, 2019). The practical implications of these findings are significant for HEIs aiming to integrate OER into their educational frameworks. Addressing the identified infrastructural challenges, such as the lack of necessary

software and internet connectivity, is crucial. HEIs should prioritize upgrading their technological infrastructure to facilitate seamless access to OER, as highlighted by Baldwin and Ching (2019). Developing comprehensive institutional policies that address intellectual property, quality assurance, and the sustainability of OER initiatives can provide a structured framework for OER adoption (Campbell et al., 2020). This includes establishing reward systems for faculty contributions to OER and ensuring management support for OER projects.

Additionally, collaboration and partnerships also emerge as key themes in the study's findings. The potential for OER to foster collaboration and build sustainable partnerships is highlighted by the perceived benefits of OER adoption, such as conducting research and building sustainable partnerships (Berk & Carey, 2009). HEIs should explore opportunities for collaborative OER projects with other institutions and stakeholders to enhance resource sharing and collective learning (George, 2021). The presence of URLs and dedicated digital library portals for OER access in the study highlights the accessibility of these resources, facilitating easy access for students and faculty. This reflects a concerted effort to enhance educational accessibility and resource sharing in Islamabad (Jasni et al., 2022). Nevertheless, enhancing faculty awareness of the benefits and practical applications of OER through targeted advocacy and communication strategies can drive broader adoption. This includes showcasing successful OER implementations and their impact on educational outcomes (Hashim & Raj, 2018). HEIs may fully realise the promise of OER to improve educational practices, promote fairness, and increase access to excellent education by aligning institutional policies, investing in infrastructure and professional development, and encouraging cooperation (Bryman, 2016).

The findings of this study add to the body of literature by offering a thorough examination of OER uptake in a developing country environment. They emphasise the potential of OER to democratise access to high-quality educational materials, especially in resource-constrained situations, and underline the crucial role of institutional support and infrastructure in supporting OER uptake. By situating the research within established theoretical frameworks and employing a rigorous quantitative methodology, the study offers valuable insights for policymakers, educators, and researchers interested in the adoption and impact of OER (Creswell & Poth, 2018). Thus, the findings highlighted the significant progress made in OER adoption among

Pakistani HEIs while also identifying critical areas for improvement. The positive perceptions of OER accessibility and the diverse range of materials used indicated a growing acceptance and integration of OER into teaching practices (Ntumi, 2021). However, addressing the identified infrastructural and technical challenges is crucial for ensuring the sustainability and effectiveness of OER initiatives (Rashwan, 2020). The study's findings determined the importance of institutional support, professional development, and comprehensive policies in facilitating the effective adoption of OER, ultimately contributing to the broader discourse on educational equity and access (Loeb et al., 2017).

5.5 Recommendation

The following recommendations aim to enhance the adoption and effective use of Open Educational Resources in HEIs in Islamabad, covering aspects of practice, policy, and future research:

5.5.1 Recommendations for Practice

i. The findings revealed that infrastructural and technical barriers are significant challenges to OER adoption. It is recommended that universities establish OER support units and implement professional development programs to provide faculty with the necessary technical assistance, training, and resources to integrate OER into their teaching practices.

ii. The study found that inconsistent internet access hinders the effective use of OER platforms. Therefore, HEIs may invest in reliable internet infrastructure to ensure faculty and students have consistent access to OER platforms.

iii. The study found that audio podcasts were the most practiced and commonly used OER element among faculty. However, videos were the least practiced teaching material. Therefore, universities may promote the use of videos and provide training and resources to integrate video content.

5.5.2 Recommendation for Policy

iv. The study revealed a need for quality and contextually relevant OER materials. It is recommended that HEC develop and implement a comprehensive OER policy that includes guidelines for quality assurance, localisation, and copyright and licensing standards.

5.5.3 Recommendations for Future Research

v. Finally, based on the technological changes and the need for continual improvement of OERs, future researchers may focus on exploring the long-term impact of OER adoption on teaching and learning outcomes.

They may identify the challenges faced by different HEIs. Future researchers may use a qualitative approach for this purpose.

5.6 Limitations of the Study

The study has certain limitations that might be acknowledged. Firstly, the research is confined to higher education institutions in Islamabad, which may limit the generalizability of the findings to other regions or educational levels in Pakistan. The public sector institutions were chosen for the study, however, both public and private were chosen for the web-analysis. Secondly, the study primarily relies on quantitative data. Websites were also evaluated using a checklist and the results were quantified. Thirdly, the OER Adoption Pyramid was adapted from the actual framework, where *'permissions'* section was removed to align with the instrument and research questions. Moreover, the sample size of the study was relatively small and focused on specific departments (Management Sciences and Education). Therefore, the results may not align with the perspectives of faculty from other disciplines. Additionally, the study did not explore the long-term impact of OER adoption, as it was cross-sectional. Lastly, the reliance on self-reported data from faculty members may introduce biases, as respondents might overstate or understate their use and perceptions of OER. Thus, the future researchers may need to address these gaps and investigate OER adoption in other HEIs from Pakistan.

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APPENDIX-I

INTERNATIONAL ISLAMIC UNIVERSITY ISLAMABAD

FACULTY OF EDUCATION

DEPARTMENT OF LEADERSHIP AND MANAGEMENT

Questionnaire for Teachers

This poll is part of a more extensive study examining people's impressions of open educational resources (OER) efforts in higher education.

OER is defined as *"teaching, learning, and research resources that are in the public domain or have been distributed under an intellectual property license that allows for free use and repurposing by others."* Unlike traditional copyrighted material, OER is "open" to editing, modification, customisation, and sharing.

This survey is designed to be flexible and accommodating. It's totally optional and will take you around 10 minutes to complete. You have the freedom to exit the survey at any point. All information in this poll is anonymous..

Instruction: Please answer the following demographic questions.

Gender: (Male) ☐, (Female) ☐

Age: (21-30) ☐, (31-40) ☐, (41-50) ☐, (51-60) ☐, (Over 60) ☐

Teaching Experience (years): (0–2) ☐, (3–5) ☐, (6–10) ☐, (more than 10 years) ☐

Department: (Management Sciences) ☐, (Education) ☐

University (AU) ☐, (IIUI) ☐, (AIOU) ☐, (NUML) ☐

Please read and evaluate each item according to the scales below:

How well you have access to teaching and learning materials?

I have access to all teaching and learning materials that I need.	Very poor	Poor	Varies	Good	Excellent
Please indicate how often you use or have used the following types of digital resources in your teaching?					
	Most Often	Often	Some-times	Rarely	Never
Videos					
Images					
Open Textbooks					
Course Elements					
Audio Podcasts					
E-books					
Infographics					
Learning Tools					
Tutorials					
Quizzes					
How strongly do you agree or disagree with the following statements of Open Educational Resources (OER)?					
	SA	A	N	D	SD
OER lower the cost of learning material					
OER are free resources available with an open license					
OER do not require permission for reuse					
Open licensing of OER enables continuous quality improvement					
Lack of peer review of OER makes them susceptible to poor quality					
OER assist my university in accessing quality materials					
Quality of OER is questionable					
OER need localization					
OER save teachers' time					

Please indicate, to what extent you have capacity to adopt Open Educational Resources?					
Skills	Poor	satisfactory	good	Very good	Excellent
Finding OER and sources					
Performing adaptations (remix different OER), including translation					
Evaluating the usefulness, determining value and quality of OER					
Understanding Copyrights, licences and how they work					
Using ICT skills					
Distributing OER and developing mechanisms to provide OER to students					
Using pedagogy skills					
How strongly do you feel motivated to adopt materials created by others in your teaching?					
	SA	A	N	D	SD
I can gain access to the best possible resources					
It promotes scientific research and education as publicly open activities					
It brings down costs for students					
It brings down costs of course development for the institution					
It outreaches to disadvantaged communities					
It assists developing countries					
Becoming independent of publishers					
Creates more flexible materials					

Conducts research and development					
It builds sustainable partnerships					
What are the most significant challenges of open educational content adoption in your institution?					
	SA	A	N	D	SD
Lack of skills					
Lack of time					
Lack of hardware					
Lack of software					
Lack of access to computers					
Lack of Internet connectivity					
Lack of content of quality and cultural relevance					
No reward system for staff members devoting time and energy					
Lack of interest in pedagogical innovation amongst staff members					
No support from management level					

APPENDIX-II

OER EVALUATION CHECKLIST

The web-analysis of the Universities will encompass checklists on OER Evaluation criteria as follows: **Clarity, Comprehensibility, and Readability; Content Accuracy and Technical Accuracy; Adaptability and Modularity; Appropriateness; Accessibility; Supplementary Resources.**

This OER Evaluation checklist adapted from the following resources:

1. Checklist for Evaluating Open Educational Resources (OER) by Texas State University Libraries is licensed under CC BY 4.0
2. Checklist for Evaluating Open Educational Resources (OER)" by ACC Office of Instructional & Faculty Development is licensed under CC BY 4.0OER Accessibility Toolkit (with Accessibility checklist) By UBC https://open.ubc.ca/access/toolkits-access/oer-accessibility-toolkit/ licensed under CC BY 4.0

Sr#	Criteria	Checklist Questions
1.	**Clarity, Comprehensibility, and Readability**	i. Is the content, including any instructions, exercises, or supplemental material, clear and comprehensible to students? ii. Is the content well-categorized in terms of logic, sequencing, and flow? iii. Is the content consistent with its language and key terms?
2.	**Content Accuracy and Technical Accuracy**	iv. Is the content accurate based on both your expert knowledge and through external sources? v. Are there any factual, grammatical, or typographical errors? vi. Is the interface easy to navigate? / Are there broken links or obsolete formats?

3.	**Adaptability and Modularity**	vii.	Is the resource in a file format which allows for adaptations, modifications, rearrangements, and updates?
		viii.	Is the resource easily divided into modules, or sections, which can then be used or rearranged out of their original order?
		ix.	Is the content licensed in a way which allows for adaptations and modifications?
4.	**Appropriateness**	x.	Is the content presented at a reading level appropriate for higher education students?
		xi.	How is the content useful for instructors or students? Teaching & Learning?
		xii.	Is the content itself appropriate for higher education?
5.	**Accessibility**	xiii.	Is the content accessible to students with disabilities through the compatibility of third-party reading applications?
		xiv.	If you are using Web resources, does each image have alternate text that can be read?
		xv.	Do videos have accurate closed-captioning?
		xvi.	Are students able to access the materials in a quick, non-restrictive manner?
6.	**Supplementary Resources**	xvii.	Does the OER contain any supplementary materials, such as homework resources, study guides, tutorials, or assessments?
		xviii.	Have you reviewed these supplementary resources in the same manner as the original OER?

APPENDIX-III

Framework Alignment of the Study

Objectives	Research Questions	Hypotheses	Theoretical Framework	Instrument
To evaluate the adoption of open educational resources in higher education institutions of Islamabad.	RQ.1: To what extent, higher education institutions (HEIs) adopt open educational resources initiatives?		Websites Analysis (OER Evaluation Criteria) Access, Availability (OER Adoption Pyramid)	OER Evaluation Checklist Access, Use of OER (Survey)
To compare university teachers' perceptions about adopting OER initiatives at higher educational institutions.	RQ.2: What is the difference between university teachers' perceptions about adopting OER initiatives at higher educational institutions?	H_{01}: There is no significant difference in the perceptions of OER adoption between male and female faculty members. H_{02}: There is no significant difference in the perceptions of OER adoption between Management Sciences and Education Departments. H_{09}: There is no significant difference in the perception of OER adoption	Volition (OER Adoption Pyramid)	Motivation to Adopt OER (Survey)

Objectives	Research Questions	Hypotheses	Theoretical Framework	Instrument
		levels among faculty members from different universities.		
To identify the university teachers' skills to adopt open educational resources.	RQ.3: What skills do university teachers use to adopt open educational resources?	H_{07}: There is no significant difference in the skills needed for fostering OER initiatives between male and female faculty members. H_{08}: There is no significant difference in the skills needed for fostering OER initiatives between the Management Sciences and Education Departments. H_{10}: There is no significant difference in the benefits experienced in OER adoption among faculty members from different universities.	Capacity (OER Adoption Pyramid)	Skills to Adopt OER (Survey)
To examine the perceived benefits of teachers adopting open educational resource initiatives at higher educational institutions.	RQ.4: What benefits do faculty members of higher educational institutions experience when using open educational resources?	H_{03}: There is no significant difference in the benefits experienced in OER adoption between male and female faculty members. H_{04}: There is no significant difference in the benefits experienced in OER adoption Management	Awareness (OER Adoption Pyramid)	Awareness to Adopt OER (Survey)

Objectives	Research Questions	Hypotheses	Theoretical Framework	Instrument
		Sciences and Education Departments. H_{11}: There is no significant difference in the challenges experienced in OER adoption among faculty members from different universities.		
To examine the challenges experienced by higher educational institutions adopting open educational resources.	RQ.5: What challenges are experienced by faculty of higher educational institutions adopting open educational resources?	H_{05}: There is no significant difference in the challenges experienced in OER adoption between male and female faculty members. H_{06}: There is no significant difference in the challenges experienced in OER adoption between Management Sciences and Education Departments. H_{12}: There is no significant difference in the skills needed for fostering OER initiatives among faculty members from different universities.	[Social and Institutional Factors] Access, Capacity, Availability (OER Adoption Pyramid)	Challenges in OER Adoption (Survey)