The adoption of technology to enhance innovative user services at CALICO libraries, South Africa.

Thundeza Mafungwa

9412255

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Department of Library and Information Science

University of the Western Cape

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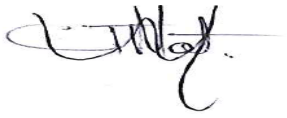
Supervisor: Dr. Lizette King

Date submitted: November 2017

DECLARATION

I Cordelia Thundeza Mafungwa declare that thesis entitled **The adoption of technology to enhance innovative user services at CALICO libraries, South Africa** is my own work and that it has not been submitted before for any degree or examination in any other university, and that all the sources I have used or quoted have been indicated and acknowledged as complete references.

Student signature: 

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ABSTRACT

The study investigated the adoption of technology of libraries part of the Cape Library Consortium (CALICO) to enhance user services. Changes in information behaviour and learning styles have been noted in higher education. Prompting the need for academic libraries to transform the delivery of user services.

The focus of the study has been on identifying technology devices and applications adopted at CALICO libraries and examining the role played by librarians in the adoption of new technologies. Exploring user services in which these technologies have been integrated. The study employed the Diffusion of Innovation theory to define attributes of an innovation that can influence an individual's decision to adopt it. A web-based questionnaire and interviews were used to gather data from librarians at the four CALICO libraries.

Academic librarians are recommended to embrace the new technologies to keep abreast of new trends, against concerns raised in the study about their attitudes towards new technologies. Their role has been described (Callahan, 1991) to be that of an agent of change through whom new technologies are made available to users.

Though new services have been created, in most instances, academic libraries have remodelled existing services. The study identified a variety of factors that have had an influence in the transformation of user services, which include, budget constraints, technology developments and new demands from library users. In spite of the need to innovate user services, the study recommended that academic librarians need to adopt technologies that are compatible with both their users' needs and existing technologies.

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KEYWORDS

Academic librarians

Academic libraries

Adoption of technologies

CALICO

Diffusion of innovation

Emerging technologies

Library user services

Service innovations

Technological developments

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ACRONYMS

ACRL - Association of College and Research Libraries

CALICO - Cape Library Consortium

CPUT - Cape Peninsula University of Technology

DOI - Diffusion of Innovations

ICT – Information & Communication Technologies

IFLA - International Federation of Library Associations and Institutions

IR - Institutional repositories

IT- Information Technology

MOOCs - Massive Open Online Courses

OA - Open access

QR - Quick response

RDM - Research Data Management

SU - Stellenbosch University

UCT - University of Cape Town

UWC - University of the Western Cape

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Chapter 1

INTRODUCTION

1.1 Introduction

The twenty-first century has seen a paradigm shift in the nature of teaching and learning in South African higher education. Shih & Allen (2007) observed that the due to rapid alteration of our collective information landscape, the learning styles of library users, and nature of library operations, usage patterns of library resources have steadily evolved from library-centric to a joint interaction between the library and library users.

Notable developments include the emergence of digital technologies, changes in the way students and academics seek and use information and the new demands and expectations that these users have of an academic library.

The study set out to determine the extent to which digital technology is adopted in Cape Library Consortium (CALICO) to transform the delivery of user services.

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1.2 Background and motivation

The CALICO academic libraries have introduced various information and communication technologies (ICTs) as a means of expanding and strengthening user services. This research project seeks to identify the new technologies employed in CALICO libraries, and consequently, to evaluate the libraries' success (or failure) in accommodating twenty-first century methods of learning and teaching.

This study investigated the innovations at four CALICO institutions in the Western Cape. The four institutions are the University of the Western Cape (UWC), the Cape Peninsula University of Technology (CPUT), the University of Cape Town (UCT) and Stellenbosch University (SU).

The Cape Library Consortium was established in 1992, it was the first library consortium in South Africa. In 2004 CALICO revised its vision and mission

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statement; it espoused to be a world class library consortium which would make use of leading edge innovations to meet information needs of users of the member libraries (CALICO 2006).

The mission statements of these four academic libraries emphasise the necessity to update their information services:

- "Enhance the research and innovation enterprise of the University through pro-vision of services, spaces and platforms that build capacity and productivity, while also heightening the visibility of locally produced knowledge" (UWC, 2013).

- "Use current technology to enhance service provisions and delivery" (UCT, 2017).

- "To provide a world class and innovative information service and learning space to the Stellenbosch University community" (SUN, 2017).

- "CPUT Libraries will develop an efficient and sustainable library service to enable us to pro-actively respond to the teaching, learning, research and scholarship needs of the institution, through innovative services, cutting-edge systems as well as excellent facilities and resources" (CPUT, 2016).

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1.3 Academic library services

The purpose of an academic library is to support teaching, learning and research in a higher education institution. Academic library services are conventionally divided into user services and technical services. User services include the circulation desk, reference desk and inter-library loans. Technical services include the acquisitions, cataloguing sections and are operating behind the scenes (Li, 2009)

Li (2009: 24) has summarised the position of academic libraries as follows, "the rapid development of modern information technologies has already laid down a solid foundation for a new innovative evolution in academic libraries in the digital age". It is imperative that academic libraries keep up with new trends and technological developments to be able to respond to users' information needs.

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1.4 Service innovation in academic libraries

According to Yen and Walter (2016: 797) innovation in academic libraries can, in general terms, refer to "evolving library services to accommodate the changing needs of users; such new and/or re-vamped services incorporate new digital technologies, and support new paradigms of teaching and research".

Jantz (2012: 4) defined innovation as "the introduction of a new product, service, technology or administrative practice into an organisation; or a significant improvement to any, some or all of these". Brundy and College (2015) refined the definition by emphasising that an idea, object or practice has only to be perceived as new by an individual or an organisational unit.

Veletsianos (2010: 13) in highlighting the characteristics of innovative use of technologies mentioned that they:

- May or may not be new technologies
- Are evolving organisms that exist in a state of "coming into being"
- Go through hype cycles
- Are not fully understood, nor fully researched
- Are potentially disruptive but their potential is mostly unfulfilled

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This study's definition of innovation in academic libraries includes significant changes and improvements to existing library services and the introduction of new services based on digital technologies.

Rowley (2011), Yen and Walter (2016) as well as Islam, Agarwal and Ikeda (2015) argued that in academic libraries innovation is directed at providing user-centred services which embrace the opportunities that information technology has afforded. Scupola (2010: 305) emphasised the importance of involving users, by stating that innovation is innovation where users have contributed to the problem solving process leading to a solution. An example is asking users to explain their needs and problems in face to face meetings and workshops or by observing how they use the library's resources.

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Brundy and College (2015) pointed out that finances also have a significant influence on innovation in libraries. Many academic libraries are faced with dwindling budgets because less funding is made available for higher education, and then there is the escalating cost of books and subscribing to online resources. When innovations to library services are under consideration meeting users' needs outweighs other demands on the library budget.

1.5 Technology developments in academic libraries

The New Media Consortium report (2017) has discussed important technology developments for academic and research libraries which includes the following services:

- The establishment of research data management services by academic libraries. These services involve data curation, developing data management workflows, identifying and selecting appropriate data storage and repository tools, archiving and publishing project results.

- Developing and managing online identities of researchers to ensure research outputs are linkable and trackable across the web. The report identified Google scholar as a technology used to create citation profiles. ResearchGate, Academia.edu and Mendeley are identified as platforms used to self-publish and share research. ORCID can be used as a unique identifier to connect the author's research output.

In 2016 the Association of College and Research Libraries (ACRL) Research Planning and Review Committee published a review of the top trends in academic libraries, the review mentions research data services, digital scholarship, collection assessment, the ACRL Framework for Information Literacy, altmetrics, emerging staff positions and open educational resources.

The IFLA (International Federation of Library Associations and Institutions) Trend Report 2016 Update has been designed to promote wide-ranging discussion and analysis of global trends regarding the role and identity of libraries. Summary of

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the themes of particular concern to the African countries who are IFLA members include the increasing demand for broadband infrastructure which can handle numerous social networks and other info-tech applications, such as Skype; live online chat facilities; the provision of MOOCs (Massive Open Online Courses) and other open educational resources; the need for institutional policies on data management and the use of mobile devices as a delivery method for information services.

1.6 Research problem statement

Digital technologies are transforming the way information is accessed and used. These developments can afford many benefits for improved user' services, therefore, librarians and library management must keep abreast of them when they seek to adopt and/or adapt their user services.

The purpose of this research was to establish how the CALICO libraries adopted, used and integrated the developments in information technology into user services; of interest, were CALICO libraries' choice of specific information technologies and the factors that influenced the choice.

1.7 Objectives of the study:

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The study aimed to:

- Identify digital technologies adopted in CALICO.
- Determine integration of digital technologies in user services.
- Enhance insight into technological trends in CALICO.

1.8 Research questions

The research problem led to the following key research questions:

1. What emerging technologies have been adopted by the CALICO libraries?
2. What are the advantages of adopting emerging technologies?
3. Did the use of emerging technologies change the delivery of library user

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services?

4. Are the adopted technologies compatible to users' needs?

1.9 Theoretical framework

The study was guided by Rogers' Diffusion of Innovations (DOI) Theory (Rogers, 1995). This theory seeks to explain how, why and at what rate new ideas and technology are spread through cultures (Chigona & Licker, 2008). Innovation, communication channels, time and social systems are identified as the main elements that influence the diffusion of a new idea and/or technology.

The Diffusion of Innovations (DOI) Theory defines attributes of an innovation that can influence an individual's decision to adopt it:

- Relative advantage refers to the improvement an innovation has over a previous one (Rogers, 1995: 216). Potential adopters want to know the degree to which a new idea is better than existing practice. Relative advantage includes people's perceptions of the benefits of adopting an innovation.

- Compatibility is "the degree to which an innovation is perceived as consistent with the existing values, past experiences and needs of potential adopters" (Rogers, 1995:224). Compatibility relates to the level of compatibility of an innovation to be adapted to an individual's life. One feature of compatibility is the extent to which an innovation can meet a user's needs. When user's needs are met an innovation is adopted at a faster rate.

- Relative complexity, which refers to the challenges of learning something new. An innovation can be classified by individuals as either complex or simply to adopt. Complexity relates to the degree to which an innovation is perceived as relatively difficult to understand and use (Rogers, 1995: 242).

- Trialability is the degree to which an innovation may be experimented with or tried out (Rogers, 1995: 243). An easy to experiment or test innovation is likely to be adopted. In library services for example a trial is organized for each database considered for subscription. Degree of complexity, relative advantage and compatibility can be determined during the trial period.

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• Observability is the degree to which the results of an innovation are visible to others (Rogers, 1995: 244). It is assumed that a highly observable innovation trends to be adopted at a high rate.

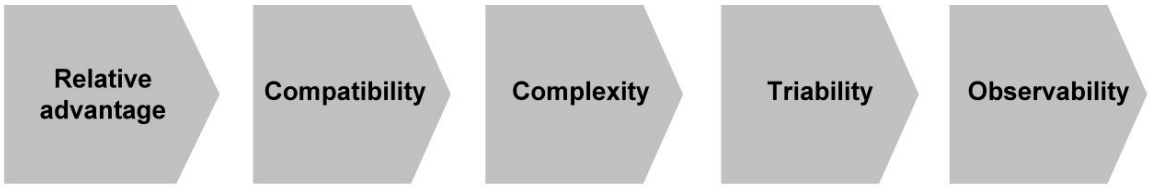

Figure 1.1: Factors influencing adoption (Investaura Management Consultants).

1.10 Significance of the study

The adoption of digital technologies plays a significant role in the delivery of academic library services. The study looks into the ways that some academic librarians develop their institutions' user services in the face of new demands from users. The researcher's findings, hopefully, will encourage academic librarians to embrace new digital library technology and not see it as a threat.

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1.11 Limitations of the study

This study focused on the adoption and use of new library technologies in four CALICO academic libraries. Participation in the study was limited to librarians; it did not include library users. The conclusions cannot be generalised to all academic libraries.

1.12 Ethical statement

At all times the researcher has adhered to the ethical guidelines of Research Committee of the University of the Western Cape. The rights of the participants were respected: participation was voluntary; the participants were informed of the purpose of the study and could withdraw at any time; their identity was confidential as they were promised anonymity.

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Ethical clearance was obtained from the four universities involved (see Appendices A – D).

1.13 Chapter Outline

Chapter 1 introduces the research project and explains the rationale behind it. The key concepts and the theoretical framework of the study are outlined.

Chapter 2 discusses and analyses existing research and professional literature on relatively digital technologies used in academic libraries.

Chapter 3 describes the research design, methodology as well as the different information gathering tools employed to collect data.

Chapter 4 presents, analyses and interprets data.

Chapter 5 concludes the study and makes recommendations.

1.14 Summary

This chapter has introduced the study by providing the background of and motivation for the study. The research problem, the study's objectives and research questions were mentioned. The theoretical framework was discussed and the use thereof motivated. The next chapter presents a review of research and professional literature on digital technology in academic libraries.

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Chapter 2
LITERATURE REVIEW

2.1 Introduction

Various factors have been identified as drivers of service innovation in academic libraries. New technology (Rowley, 2011), reduced library budgets, expenditure cuts as well as changes in consumer expectations and behaviours (Jantz, 2012) are forcing libraries to rethink the services offered to users. Raju & Schoombee (2013: 27) have pointed out how "changing higher education pedagogy has stimulated new thinking with regard to innovative learning spaces and aligned new services". Technological innovations of particular interest are those designed to enhance the delivery of information services to the students and academic staff (Rowley, 2011). This literature review focuses on the role librarians played in adopting and implementing emerging technologies to enhance library user services. The literature review further concentrates on the adoption of technologies in recent years by academic libraries which resulted in the following innovations:

- Virtual reference services
- Mobile services
- Online tutorials
- eBooks
- Research support
- Collaborations

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2.2 Librarians as adopters of technology

A review of literature on how the adoption of emerging technologies has improved services in academic libraries, revealed that there is little research on librarians as adopters of technology (Rabina & Walczyk, 2007). Research has focused on library users' adoption of technology rather than on librarians as technology users. Zinn and Langdown (2011) concluded that a similar situation exists in South Africa. Rabina and Walczyk (2007) have acknowledged the key role that librarians play in

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the diffusion of innovation within a library. Librarians introduce new technologies to users and then instruct and assist them in using them. Blackburn (2011), who studied millennial librarians, agrees with Rabina and Walczyk (2007) that librarians can promote the adoption of new technology in their libraries.

Callahan (1991) describes the role of a librarian in the diffusion of technological innovation as that of an agent of change, through whom the new technologies will not only be made available to the library users but from whom the library users will gain an understanding to effectively use the innovations. Vanwynsberghe, et al (2014) emphasized that successful implementation of social media in libraries is associated with how proficient librarians are in social media use themselves.

2.3 Virtual reference services

Staff and students' expectations about how and where they can access information have changed dramatically with the introduction of roaming or roving reference service which extended beyond the fixed reference desk and even the library building. This type of reference service eliminated "the physical [barrier] that the traditional reference desk represents" (McCabe & McDonald, 2011: 4). A librarian could assist patrons anywhere whether they were in the library or outside.

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McCabe and MacDonald (2011) reported on the roving reference services project at the University Northern British Columbia (UNBC) in Prince George. Because the number of queries at the traditional reference desk declined, a "roaming" or virtual reference service was created at UNBC as a means of reaching patrons who would not normally approach the reference desk for assistance. Roaming also enhanced to the existing chat service offering online reference assistance. As part of the project an iRoam widget was developed and placed on the UNBC Library's homepage. The widget indicated that an iRoam librarian was moving around the library, allowing students to approach the roaming librarian or chat to the librarian online (McCabe & MacDonald, 2011). UNBC librarians equipped with an iPad, were expected to wander through the stacks and into the computer laboratories to

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meet and greet students along their way. An iRoam shift lasted ninety minutes. The iRoam librarians were to spend up to thirty minutes roaming through the library, with a minimum of two roam shifts. Librarians were also encouraged to roam outside the library. After a thirty minute roam, the librarians could return to their offices to respond to chat requests via the iPad.

UNBC librarians identified the locations on campus where students would be best served and they roved between these points for approximately four hours each week. They attended events sponsored by student organisations, such as the Graduate Student Association and the Department of Off-Campus Student Services in order to advertise and test the roving service. The project was expanded to cover the hours that commuting students were more likely to be on campus and librarians visited areas where students congregated, such as the commuter lounge, the university counter and academic offices. Later in the project, librarians attended research workshops, which were sponsored by the Office of Undergraduate Research, and meetings for returning students, which were held at the Women's Center and the Library's new 24-hour study space. Initially the roving service was aimed at graduate students, but it then spread beyond the library building to reach many undergraduates and faculty members who needed help, wherever they were on campus.

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The project coincided with the launch of the Apple iPad. Librarians needed a small, light, mobile and user-friendly computer which connected to the university network and the internet and the iPad was a perfect fit (McCabe & MacDonald, 2011). Two months prior to the introduction of the iRoam service, Weller Library at UNBC provided the reference staff with iPads so that these librarians could familiarise themselves with the new IT device (McCabe & MacDonald, 2011: 5). Based on the roaming statistics McCabe & MacDonald (2011) concluded that the roaming service was a success. The main advantage was that it enabled librarians to provide reference services throughout as well as beyond the library buildings. Relative advantage is important in determining the success of an innovation. Blackburn (2011) has identified social prestige as an important factor in measuring relative advantage. As students are interested in new IT devices, it provided a relative advantage in marketing the roving services.

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The University of Maryland, Baltimore County librarians realized that they needed to change the way they marketed library resources and services to graduate students (Gadsby & Qian, 2012:1). Librarians tried out a roving reference service on campus so that they could be on hand whenever and wherever the users asked for help (Gadsby & Qian, 2012).

Librarians needed a device that could connect to the library's information resources. Initially librarians wanted a mobile device, such as a netbook or small computer, which could access these resources from any point on campus. In the end, they chose the iPad, which had wireless and 3G connectivity (Gadsby & Qian, 2012: 3). Trial on using the iPad seemed to have motivated librarians to choose the device for the roving services. This corresponds with the observation that people are more likely to adopt an innovation, when it is visible, that is, the results of using it can be seen and when a new design stimulates peer discussions (Blackburn, 2011: 666 and Maloney & Wells, 2012).

Sharman (2012) reported on the roving librarian service at University of Huddersfield. Armed with tablets the subject librarians were able to reach the university community beyond the library building. Each subject librarian was offered an iPad or Android tablet because of their portability. Most librarians chose the Asus Eee Pad Transformer, an Android tablet, which had greater flexibility than the iPad as for example, the Android device could accommodate a separate keyboard and a flash drive. Librarians were used to laptops and personal computers with keyboards and so preferred the Asus Eee Pad Transformer.

A colourful logo with the strapline "bringing information skills to you" was stuck on the roving librarian's tablet and posters advertising the times at which a roving librarian – also carrying the logo - would be at specific locations. The posters were displayed on the university's plasma screens and the library's Facebook page. The roving locations included social areas, such as cafes or busy foyers and corridors, and working areas, such as resource centres. Roving librarians asked the students, whom they helped, to complete a three item questionnaire which had been loaded on the librarians' tablets. The questionnaire asked the students how often they used the library and its electronic resources and whether they thought that other students

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would make greater use of library resources if they had the same help. More than 80% of the students surveyed said that the roving service would see an increase in the usage of the library and its resources.

Sharman (2012) highlighted giving librarians an opportunity to trial with iPads and sharing the experience with colleagues. Library and faculty staff established closer working relationships as a result of the interactions while roving. Sharman agreed with Gadsby and Qian (2011) as well as with McCabe and MacDonald (2012) that students are drawn to "cool librarians" using up-to-date technology.

2.4 Mobile services

Quick response (QR) codes have been used by libraries to facilitate quick and easy access to library services and resources. Coleman (2011: 1) has described how QR codes work by stating that "QR codes are two dimensional images that when scanned by a smartphone's camera prompts the smart phone to open a webpage or display an image, video or text". A QR code can be used to access data as most smartphones and mobile phones with cameras can read them (Mohamed: 2013).

Mohamed (2013) undertook a case study on the use of QR codes at the Brand van Zyl Law Library at the University of Cape Town. Although the study targeted law students, it aimed at assessing how well QR codes provided easy access to library resources. An advantage in using QR Codes is that they can be read by mobile phones.

Mohammed's case study comprised of three components:

- A needs analysis. This was undertaken to establish the information needs of law students. An information sheet about QR codes, with a short questionnaire attached, was distributed to the students.

- A manual and a training guide. The researcher prepared a manual on QR codes in the form of a wiki for the Law Library staff and a QR code library training guide for the students. The students could access the guide on the Law Library homepage.

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- A competition. A QR code competition was arranged to encourage library patrons to use QR codes as a research tool.

The study revealed that the students were initially unfamiliar with QR codes. They were however eager to use them. Based on this finding, Mohamed (2013) concluded that some knowledge of and training in the use of QR codes was necessary before the students were ready to use QR codes.

Walsh (2010) reported on the use of QR codes at the University of Huddersfield Library. He observed students using their cell phone cameras to take pictures of catalogue records, showing that there was a need to bridge the gap between physical and electronic resources. He saw that QR codes could link to and display the information that most students were familiar with. Users needed to download a QR code reader on to their cell phones before the QR codes could then link a scanned item to a live version of the catalogue or to electronic resources and instructional videos (Walsh, 2010).

Both studies highlighted the necessity of briefing and training library staff in advance. Scupola (2010), Walsh (2010) and Mohamed (2013) reported that some students had difficulty in finding and installing a QR code reader resulting in it becoming a barrier to their adopting the use of QR codes. Walsh (2010) recommended that information desk staff should promote QR codes by helping students to install QR codes readers and by demonstrating the use of QR codes on their own mobile phones.

2.5 Online tutorials

Online tutorials provide an alternative means of training library users, for students can access these tutorials whenever they need help and can dictate the pace. Libraries are using screen- casting to create online tutorials as a new way of engaging library patrons besides the traditional face-to-face interaction. Oud (2009) and Small (2010: 2) have defined screen-casting programs as software that allow you to make a video recording, with a sound-track, of your onscreen demonstration, training or presentation. Clients can watch the recording whenever they need help

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resulting in ‘just-in-time’ training which can be delivered online at any time of the day or night.

Librarians at Stellenbosch University (SU), South Africa used Adobe Captive screen casting software to create online tutorials which students could view in their own time (Visser, 2013). Adobe Captive was selected because the SU Department of Information Science already had a licence. Librarians collaborated with the Department of Information Science to present a credit-bearing Information Skills programme compulsory for all first-year students from four faculties. Librarians presented the “Use of library services at SU” section of the programme. The online tutorial format was chosen as this would save on contact time and obviate repeating the same lessons every time there was a request for help (Visser, 2013).

Blackburn (2011) has discussed how the visibility of an innovation and the availability of information evaluation can encourage the adoption rate of an innovation. The degree with which an innovation may be experimented can also influence adoption. SU faculty librarians were impressed with Adobe Captive and ten licenses were bought. Screencast tutorials were posted on WebCT.

Focus group discussions with second year students who were part of the Information Skills programme the previous year, were initiated to determine how or if students benefited from screencast tutorials. Only five students from a class of two hundred and eighty turned up for focus group discussions. Most of the students who took part in the focus group discussions could not answer the questions (Visser, 2013). Some did not know about the screencast tutorials. Others were not interested in the Information Skills programme. Visser (2013) concluded that the screencast tutorials project was not successful. Although the screencast tutorials were compatible with WebCT, an e-learning platform which the students were already using, it did not turn out to be advantageous as feedback from students revealed that they never used the screencasts. Some claimed they were not aware of these online tutorials. While others said that they did not open links on WebCT unless they were sure that the information would be of value.

At the University of Texas, Arlington (UTA), Bailey (2012) created screencasts in response to frequently asked reference questions from students and academic staff.

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Thirty-nine screencasts were embedded in the UTA Library's LibGuides pages. "The choice of screen-casting software was based on cost, ease of use, accessibility from various workstations and level of user friendliness" (Bailey, 2012: 10). The university community, including library staff, were asked to complete a survey to determine customer satisfaction. Bailey (2012) reported that the overall response was positive. Participants indicated that they really liked having visual demonstration of various processes, which they could view again and again. However, the survey also established that the usefulness of the screencasts varied depending on whether a library patron had an actual information need. It was also concluded that the need (or lack thereof) to learn the process of finding information will influence how a library patron would perceive screencasts.

2.6 e-Books

Zinn and Langdown (2011) conducted a study about the adoption of e-books by academic libraries in South Africa. A questionnaire was distributed on the Library and Information Association of South Africa mailing list. The study established that e-books are being taken into library collections gradually and that e-book adoption is dependent on the purchasing and collection development policies of libraries (Zinn & Langdown, 2011).

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In 2011, Hussong-Christian, Nichols, Bridges and Lajoie (2013) studied the adoption of e-readers by Oregon State University Libraries (OSUL). Rogers (1995) innovation – decision process was used as a theoretical framework to analyse participants' e-reader adoption. Both studies by Zinn and Langdown (2011) and Hussong-Christian, Nichols, Bridges and Lajoie (2013) have highlighted the challenges that e-readers present. Zinn and Langdown (2011) stated that academic librarians' enthusiasm for e-books was dampened because of problems such as the cost of equipment to read e-book formats, the cost of e-books themselves, especially if the subscription purchasing model is used, and reliability of the internet.

Hussong-Christian, Nichols, Bridges and Lajoie (2013: 18) revealed that in response to recommendations, OSUL introduced the following changes: extension of the length of e-book loans from seven to 28 days; access to e-books from the

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library catalogue, creation of a search widget on the e-book guide and the installation of Adobe Digital editions on all computers in the Information Commons as well as on OSUL's discovery search platform. These changes resulted in increased e-books usage.

2.7 Research support

Information technology has radically changed social communication patterns and information behaviour, which has affected both scholarly communication and the forms of scholarly publications (Alam, 2014). For most universities increasing research output is a strategic priority. Academic libraries are required to support research. Raju and Schoombee (2013: 28) define research support as "the provision of a new and expanded suite of services such as research data management, curation and preservation, facilitation of open access and bibliometric analysis".

2.7.1 Bibliometric services

"An emerging technology for scholars is in the area of tracking of research impact" (Yang & Li, 2016), in other words, measuring the impact or influence of their research. Karasmanis and Murphy (2014: 7) have indicated that researchers can use research metrics to support applications for funding, grants, academic promotion, performance evaluation and benchmarking; as a means for identifying potential collaborators and emerging areas of research and for evaluating the impact and quality of a journal. In response to these new demands from researchers, librarians need to include research metrics into information services.

Karasmanis and Murphy (2014) reported on a research impact service offered at La Trobe University in Melbourne. They highlighted the necessity for faculty librarians to be well informed about research metrics. The La Trobe University Library offered a number of interventions to train faculty librarians. These interventions included information sessions, a workshop conducted by an external trainer, and an intensive five-day course that had been developed by the Queensland University of Technology. Librarians then created LibGuides on citation analysis and publishing options.

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According to Karasmanis and Murphy (2014: 9) the research impact service at La Trobe University Library provides "advice on researcher profiling tools, e.g. ORCID, Researcher ID, Scopus author ID, and on social media tools for promoting research online, e.g. Google Scholar, ResearchGate, Microsoft Academic Search and Academia.edu. Profiling tools help to connect scholarly work done by the researcher and to help identify the correct details of a scholar who produced research output.

Raju and Schoombee (2013) examined the research support services offered by Stellenbosch University Library. La Trobe University Library and Stellenbosch University Library have both made available LibGuides with information about bibliometric tools and resources. Because the SU research support service was still under development, Raju and Schoombee (2013) had to admit that limited research impact service was offered then. Faculty librarians could by using Google Scholar and Google Scholar metrics "assist with queries related to h-index, journal impact factor and journal citation reports" (Raju & Schoombee, 2013: 35).

Gumpenberger, Wieland and Gorraiz (2012) reported on the bibliometric practices at Vienna University Library. These practices included the formation of the Inter-Institutional Working Group "Scientometrics". The Working Group was created to co-ordinate the activities of the university units that dealt with scientometrics. In 2009 the efforts of the Working Group resulted in the establishment of the new Bibliometrics Department at the Vienna University Library.

According to Gumpenberger, Wieland and Gorraiz (2012) the Bibliometrics Department provided database training sessions for students and research staff, ran workshops on bibliometrics, developed partnerships with industry and took part in national and international projects. The Bibliometric Department of Vienna University was one of the first university units to join ORCID - an international project that aims to address the ambiguity of scientists' names and affiliations (Gumpenberger, Wieland & Gorraiz, 2012).

The libraries at La Trobe University, Stellenbosch University and the University of Vienna all used Google Scholar as a bibliometric tool.

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2.7.2 Research Data Management (RDM)

Chiware and Mathe (2015: 2) have stated that RDM services refer to the storage, access and preservation of data produced in particular investigations or research projects. RDM services include data management planning, digital curation and metadata creation. Chiware and Mathe (2015) agree with Van Wyk and Van der Walt (2014) that the aim of RDM services is to ensure research integrity and to facilitate the re-use of data in the future to avoid duplication of effort because existing data may be used.

Chiware and Mathe (2015) reported that RDM services are included in CPUT Library's e-strategic plan which links closely to the institutional goals. The Research, Technology, Innovation and Partnerships research strategy defines the CPUT Library's role in RDM support as the curation, dissemination and promotion of traditional outputs of research, namely, articles and theses, and the curation of research data and innovation output, such as enhanced research data.

CPUT created an institutional RDM Working Group which drew on the Library, Research Office, Faculty research representatives, ICT staff, Records and Archives Services, the Institutional Quality Management unit, the Institutional Ethics Committee Chair, Research Chairs, Heads of Research Units and Centres, and the Centre for Postgraduate Studies. This Working Group developed the CPUT RDM policy. The RDM services at CPUT are part of e-Research Infrastructure and Communication (eRIC), a joint project which involves information specialists in academic and research libraries all over the world. Academic and research libraries in Germany, South Africa and Thailand are collaborating with systems developers, IT experts, and experts in various fields in order to develop software platforms and services which will support RDM (Chiware & Mathe, 2015). Each institution is in charge of developing its own RDM platform. The exchange of ideas through working committees and groups, the transfer of skills and problem solving are the products of collaboration.

The University of Pretoria began by developing a policy for the preservation and retention of research data. It was followed by a survey of RDM practices at the university (Van Wyk & Van der Walt, 2014). After drafting an RDM policy and

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then surveying current RDM practices, the University of Pretoria set up a task team to investigate a campus wide RDM infrastructure (Van Wyk & Van der Walt, 2014).

Chiware and Mathe (2015), Van Wyk and Van der Walt (2014) and Ball (2013) concur that RDM cuts across a number of services and involves many groups of stakeholders like IT services, libraries and research offices. The advantages derived from RDM services, according to Chiware and Mathe (2015) and Van Wyk and Van der Walt (2014), are that these arrangements ensure research integrity, save time and prevent the duplication of effort because other researchers can use curated data.

While universities are at different stages in the process of establishing RDM services, most have developed an RDM policy, run trials to audit current RDM practices and identified researchers' needs.

2.7.3 Open access (OA)

Jain (2013: 2) has defined open access as the immediate provision of free, permanent online access to full-text research articles to anyone. Raju, Claassen and Moll (2016: 35) have a detailed definition, "the explicit removal of price barriers (such as subscriptions, licensing fees, pay-per-view fees) and permission barriers (such as most copyright and licensing restrictions) to the end user". The demand for open access is fuelled by increasing costs of scholarly and scientific journals (Raju, Claassen & Moll, 2016 and Jain, 2012). Technology development has accelerated open access and the growth of the internet has enhanced the capacity to share scholarly literature freely on a global scale (Raju, Claassen & Moll, 2016). There are two main approaches to open access (Jain, 2012). The first approach (also known as the green route) is self-archiving of articles on the internet or in open access archives, for example, in institutional repositories. The second approach (known as the gold route) is publishing in an open publishing journal (Gargouri, Larivière, Gingras & Harnad, 2012:1). Raju, Adams and Powell (2015: 142) have stated that the green and gold routes are "the pillars of open access" and recommended that academic libraries should consider co-operating with university publishers as this would help disseminate research produced at the university.

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One of the benefits of OA is that an institution's research output is more readily accessible through digital repositories, which leads to increased downloading of articles and, ultimately, improves citation counts. It also raises the visibility of an institution and its researchers, which in turn, facilitates collaboration with other institutions. Raju, Claassen and Moll (2016: 37) emphasise that "the purpose of OA in the African context should be driven by a social justice ethos". A commitment to social justice would support the provision of free textbooks to students, advance electrification and the upgrading information technology and expand bandwidth.

According to Dorner and Revell (2012) institutional repositories (IRs) at universities are a relatively recent innovation. IRs make it easy for anyone to access the outputs of academic staff and research students. A research project conducted at three New Zealand universities was based on Rogers' Diffusion of Innovations theory (Dorner & Revell, 2012). Semi-structured interviews were conducted with nine librarians drawn from the Humanities, the Social Sciences, and the Sciences. The interviews incorporated Rogers' five attributes of innovations (Dorner & Revell, 2012). Librarians agreed that the discoverability of theses and dissertations through Google scholar was a relative advantage. Based on this study's findings that librarians had done little to promote IRs, it was recommended that librarians promote the deposit of research into IRs as well as use of IRs to access research resources.

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2.8 Online collaborations

Yang and Li (2016) have defined collaboration as actions that involve two or more people working together in their effort to create something, such as a paper, meeting, presentation or a class plan. Emerging technologies provide a virtual environment where collaborators in different locations can work together.

Three editors, who lived in different places, explored the usefulness of emerging technologies in meeting their needs as collaborating editors, as they were editing a collection of essays (Tolley-Stokes, 2011).

The editors initially tried out wikispaces because it provided a space where they could work together on the various drafts of the essays until the final version was

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achieved (Tolley-Stokes, 2011). The editors could review all the changes and even re-instate earlier versions of the text (Tolley-Stokes, 2011). However, file management proved difficult and there were concerns about violating other contributors' privacy. As a result, the team sought alternative tools.

Manymon is a free project management program which is available on the internet. Editors tried it out because it had a feature which offered contributors confidentiality (Tolley-Stokes (2011: 123). Other advantages were that Manymon could notify contributors of deadlines, and tasks could be assigned to different team members. The disadvantage was that editors' comments could not be added within the document.

The team briefly adopted Google Wave, but there were problems with some browsers, the co-editors were not prepared to change to the browsers specified by the program. DimDim was used for teleconferencing when face to face discussion was necessary (Tolley-Stokes, 2011: 124). The team eventually settled on Google Docs, a cloud based application which allows for the uploading of files, presentations and forms.

Ennis and Tims (2010) reported on the use of SharePoint by the Library at the University of Alabama-Birmingham (UAB) Information Technology unit. The Library made use of SharePoint for training, interlibrary loans and virtual reference. The training sessions included a form that allowed anyone in the UAB community to request a class. Librarians could add additional data, and users could track the status of their requests. Reference staff could track their virtual reference encounters and create a knowledgebase for frequently asked questions.

University of Maryland University College (UMUC) Library decided to experiment with SharePoint as UMUC Library staff wanted to be able to organise documents and share knowledge (Diffin, Coogan & Fu, 2013). Diffin, Coogan and Fu (2013) revealed that because only some procedures were documented before SharePoint was implemented, knowledge sharing and learning were undermined. The lack of best practices resulted in no systematic effort in creating, organizing and sharing knowledge among the whole team.

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Ennis and Tins (2010) stated that the reference staff at UAB felt that SharePoint was relatively easy to use. In contrast Diffin, Coogan and Fu (2013) reported that UMUC reference staff found SharePoint difficult to use because they could not access the Reference Manual remotely.

2.9 Summary

The rapid development of technology and their adoption by academic libraries has transformed the way academic librarians access, deliver and share information. Technology enables academic librarians to provide better training and services as well as greater research support to students and academics. For academic libraries to remain up-to-date, user services should be aligned to information behaviour trends. To be well equipped to choose appropriate emerging technologies that will meet the needs and preferences of individual users and specialist groups, all library staff members need to be trained in the use and applications of the new technologies. The next chapter discusses the research design and methodology used to collect data for the study.

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Chapter 3

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter presents the research design and methodology used by the researcher. The chapter begins by outlining the aim of the study and revisits the research questions. It then explains the research design, the population, sampling method and how data was captured and analysed.

3.2 Aims of the study

From the literature review in the previous chapter, it is clear that technological developments are identified as one of the major causes for academic libraries to adapt to the 21st century. Therefore, this study aimed at:

• providing information on new technologies which could be introduced into the user service of an academic library,

• establishing which applications of emerging technologies have been adopted by the CALICO libraries,

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• supplying guidelines on how to integrate or apply these technologies in order to improve the delivery of user services and

• finding examples of creative ways of using these technologies to reach out to library users.

The research problem leads to the following key research questions:

1. What emerging technologies have been adopted by the CALICO libraries?
2. What are the advantages of adopting emerging technologies?
3. Did the use of emerging technologies change the delivery of library user's services?

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4. Are the emerging technologies compatible with users' needs?

3.3 Research design and methodology

Fuller (2010: 1249) defined research as a comprehensive process of inquiry. The purpose of a research design is to produce data that will enable a researcher to draw explicit conclusions from the data (de Vaus, 2004: 965). According to DeForge (2010: 1253) research design is the plan that provides the logical structure that guides the investigator to address research problems and answer research questions.

There are three recognised approaches for conducting research: quantitative, qualitative and mixed methods (Maree, 2012). Quantitative research can be defined as research involving the collection of data in numerical form for quantitative analysis. The numerical data can be durations, scores, counts of incidents, ratings, or scales (Garwood, 2006: 251).

Maree (2012: 15) has defined a qualitative study as an inquiry process of understanding where a researcher develops a complex, holistic picture, analyses words, reports detailed views of informants, and conducts the study in a natural setting. Types of qualitative research include individual and focus group interviews, observations or document analysis.

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A mixed research method combines qualitative and quantitative approaches. According to Creswell (2014: 4) mixed methods research is an approach to an inquiry involving collecting both quantitative and qualitative data, and then integrating the two forms of data.

This study has used both qualitative and quantitative approaches. The mixed method research design was chosen because it allows both quantitative and qualitative data to be used to identify attitudes and opinions about the adoption of emerging technologies by academic libraries and trends in service innovation that are the result. The explanatory sequential mixed methods approach was used, which is described by Cresswell (2014) as the collection and analysis of quantitative data followed by a collection and analysis of qualitative data. The researcher chose a

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combination of a web based questionnaire, follow-up interviews and a scan of academic library websites to gather data which would allow a comprehensive analysis of the research problem.

3.4 Population

The population under study were academic librarians at four university libraries in the Western Cape, South Africa part of the CALICO Library Consortium. Kumar (2014: 384) has described a population as the subject or as in this case, people, you want to find out about. A population could be a group of people living in a specific area, employees of a company or a community. As the study focused on technology to enhance the delivery of library services, the target population were the faculty or subject librarians (variant terms used in different libraries for the same rank), as they are the librarians who provide reference and information services directly to students. Because the study focused solely on subject or faculty librarians, it seemed appropriate to include all the librarians in this category. No sampling was therefor done. The researcher was able to identify all the subject or faculty librarians, from the websites of the four university libraries, to be part of the study population.

Table 3.1 displays the number of faculty or subject librarians at the individual academic libraries:

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Table 3.1: Number of faculty/subject librarians	
University	**Number**
Cape Peninsula University of Technology (CPUT)	17
University of Cape Town (UCT)	23
University of Western Cape (UWC)	10
Stellenbosch University (SU)	18
Total	68

From Table 3.1 it can be seen that the population, and consequent sample, consisted of a total of 68 subject or faculty librarians from the CALICO libraries.

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3.5 Information gathering instruments

"When using qualitative inquiries, researchers use triangulation as a strategy to identify, explore, and understand different dimensions of the units of study, in order to strengthen their findings and enrich interpretations" (Rothbauer, 2012: 2). For this purpose, the researcher selected three information gathering tools, namely, a questionnaire, interviews and a detailed scan of the library websites to gather data. The study used this multi-method approach as a means of testing the validity of the research findings.

3.5.1 Questionnaire

One of the advantages of a questionnaire is that it can be administered remotely, for example, by phone, email or a post (Leedy, 1997). A questionnaire is an appropriate method for gathering data from participants at different institutions, because they provide anonymity as there is no face-to-face interaction between respondents and researcher, which therefore, increases the likelihood of obtaining accurate information. The disadvantages of this approach, which Kumar pointed out (2014: 181), include, a low response rate because the topic is not interesting enough, or the layout or length of the questionnaire put respondents off. Connoway and Powell (2010: 167) have added another disadvantage stating that if a questionnaire is distributed electronically, it will reach only those who have access to and are familiar with using email and web technology. A questionnaire is limited to a population that can read and write; it excludes people who are illiterate. The last mentioned disadvantage does not apply to this study, since the target population is well qualified with at least an undergraduate degree and, as librarians in academic libraries, all have access to the internet and email at their places of work.

3.5.1.1 Questionnaire design

The questions were informed by Rogers' Diffusion of Innovations (DOI) theory, which offers an explanation of how, why, and at what rate new ideas and technology are spread through cultures (Chigona & Licker, 2008). The questions covered the

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characteristics of an innovation that can influence how quickly an individual will adopt an innovation, as laid down in the DOI theory (Rogers, 1995): These include

- The advantage gained by adopting a new technology against sticking with an existing one;
- The compatibility of an innovation with a user's needs;
- How user friendly the innovation is;
- Whether the innovation can be tried out before it is adopted;
- The visibility of an innovation

The questionnaire (see Appendix E) was divided into three sections. Section A focused on personal information. It included six close-ended questions about the respondents' age, gender, level of education and position at work. Section B included five questions about the applications and tools that the respondents have adopted and with which they work. Some questions included rating scales. Section C contained thirteen open-ended questions that measured the respondents' perceptions of and attitudes towards the adoption and use of emerging technologies. "Open-ended or unstructured questions are designed to permit free responses from participants rather than ones limited to specific alternatives" (Connoway & Powell, 2010: 149). Open-ended questions afford respondents the opportunity of responding to questions without limiting what they might want to say. However, there can be a disadvantage as "open-ended questions may also discourage responses because they typically take longer to answer" (Connoway and Powell, 2010: 149).

Since all librarians included in the study had access to email, the researcher took advantage of being able to use an online questionnaire. The researcher thought it was most appropriate to use an online questionnaire given that the subject of the study was the adoption of new information technologies. Another advantage is that there were no costs incurred in collecting the data. Fox, Murray and Warm (2003) drew attention to the ease of data gathering using web-based research. The questionnaire was created using Google Forms, a web-based form, which

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participants had to complete and submit online. Google Forms also made it easy to keep track of the responses.

3.5.1.2 Pre-testing the questionnaire

The questionnaire was piloted on seven colleagues at CPUT, who were not included in the study, in order to get feedback on how participants might interpret the questions. The responses were then used to revise a few questions.

3.5.1.3 Administering the questionnaire

As already mentioned, the researcher scanned websites of the CALICO university libraries in order to determine the number of the subject or faculty librarians at each institution and to compile a list of their e-mail addresses.

Before the questionnaires could be distributed, ethics clearance (see Appendices A - D) had to be obtained from the four universities. The process of applying for ethical clearance became a lengthy exercise. Ethics clearance from UWC was obtained automatically once the research proposal had been accepted and the research project registered with the university. Getting permission from the other research sites was problematic. One institution took more than six months to reply. After ethics clearance was granted, two of the universities distributed the questionnaires as stipulated by their university policies. This meant that the researcher had no control over the distribution of the questionnaires at these institutions. The remaining institution granted clearance and gave the researcher permission to send the questionnaires to the targeted librarians.

An information sheet and a consent form accompanied the questionnaire (see Appendix F and G). The information sheet provided the contact details of the researcher and her supervisor. The participants were able to contact the researcher or supervisor if they had queries. Participants were asked to complete the consent form and return it with the completed questionnaire to the researcher.

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In an attempt to save time while waiting for clearance from the fourth institution, the questionnaire was mailed to the identified subject or faculty librarians at the three institutions which had granted permission. Only six librarians returned the questionnaire resulting in a very low response rate. A few months later, after ethics clearance was granted by the fourth institution, a second set of questionnaires was sent to the target subject or faculty librarians at the four institutions. Nineteen responses were received. Due to the low response rate (28%), follow-up interviews were scheduled after the data from retrieved questionnaires had been analysed and gaps in the findings identified.

3.5.2 Interviews

Firmin (2012) declared that qualitative research interviews are foundational means of collecting data. The interview techniques used in qualitative data collection range from unstructured conversations to open-ended and/or semi-structured interviews (Lopez, 2012).

This study made use of semi-structured interviews. Semi-structured interviews use different open-ended questions in order to discover the participants' perceptions on the topic of interest.

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An interview guide was developed (see appendix H). It outlined a series of questions that the researcher intended to ask. "One likely reason for the popularity of question based interviews guides is their ability to suggest probes and follow-up questions that can elaborate on the basic set of questions" (Morgan & Guevana, 2012: 470).

Invitations were e-mailed to subject or faculty librarians. The researcher obtained addresses of librarian's emails from the four CALICO libraries' websites. An information sheets about the interview process accompanied the invitations. Seven librarians accepted the invitation to be interviewed. Interview times were arranged with the individual librarians resulting in the researcher conducting seven face-to-face interviews. The interviewees were asked to read and sign a consent form (see appendix I) before being interviewed. The researcher asked each interviewee for

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permission to use of a digital recorder to record the interviews. Recorded interviews were transcribed for data analysis.

3.5.3 Scanning websites

The researcher scanned the websites of the four university libraries in order to crosscheck data obtained from the questionnaires and interviews. The library home pages were examined for information about application of technologies. The scanning took place during the same week to ensure

3.6 Data capturing, analysis and presentation

The choice of using Google Forms to create and administer the questionnaire meant that the researcher could create an online questionnaire and that data from respondents could be captured directly into a Microsoft Excel spread sheet. The variables were presented in columns and the participants in rows. Microsoft Excel was also used to capture the data from the interviews.

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Data analysis involved interpreting the data collected from three sources, the questionnaire, the interviews and the library web sites. Different methods were used to analyse the data from the questionnaires and the interviews.

The quantitative data from the questionnaires was analysed according to the research questions, in terms of statistical frequencies and percentage distributions. The data was presented in the form of graphs and tables created with Microsoft Excel.

Thematic analysis was used to analyse the qualitative data "to ensure a systematic approach by identifying themes or patterns of cultural meaning, coding and classifying textual data according to theme, and interpreting the resulting thematic structures by seeking commonalities, relationships, overarching patterns,

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theoretical constructs or explanatory principles" (Lapadat, 2010: 2)".

3.7 Summary

This chapter has described the research design and the methodology used to collect and analyse data. The researcher presented an argument for choosing a mixed methods approach which employed a web-based questionnaire, semi-structured interviews and scanning the respective library web sites to verify the data collected. The design and administration of the questionnaire, conducting of the interviews, and website analysis were explained. Methods of data analysis, presentation and interpretation were explained.

The next chapter will present and analyse the captured data.

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Chapter 4

PRESENTATION AND INTERPRETATION OF DATA

4.1 Introduction

This chapter presents and interprets data collected by means of a questionnaire, interviews and from websites in order to understand how various technologies had been used to enhance user services at CALICO libraries. Data interpretation was framed by the Diffusion of Innovation theory and related literature. The data was captured from nineteen questionnaires, interviews with seven librarians and the analysis of the four websites of the CALICO libraries.

4.2 Questionnaire

4.2.1 Section A: Personal details

The first section of the questionnaire gathered information about the nineteen librarians who answered the questionnaire: where they worked, how long had they been in their current in position, their age, gender and their current studies, if any.

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4.2.1.1 Institution

Respondents were asked to indicate which institution they worked for. From the answers the researcher could calculate the number of respondents from each of the four university libraries members of CALICO. Figure 4.1 shows that seven (37 %) of the respondents work for the Cape Peninsula University of Technology; four (21 %) are employed by the University of Cape Town; four (21 %) by the University of the Western Cape and four (21 %) by Stellenbosch University.

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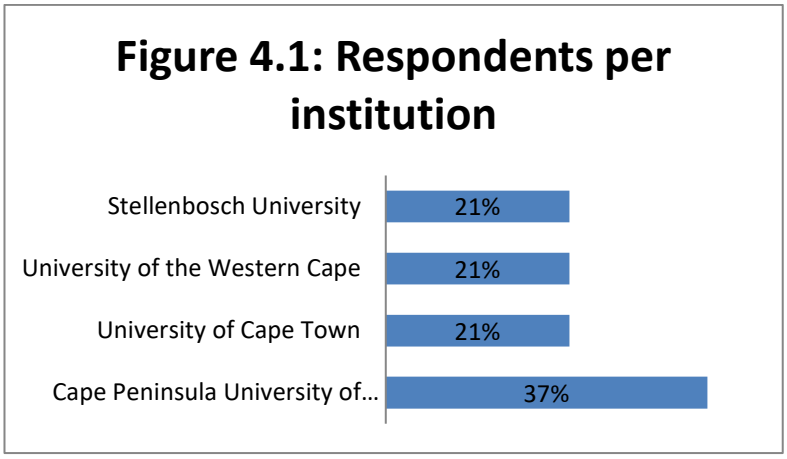

Figure 4.1 shows that there were an equal number of respondents from SU, UWC and UCT with slightly more respondents from CPUT.

4.2.1.2 Years worked in current position

This item required respondents to indicate how long they had worked in their current position. The options were: 2-5 years, 6–10 years and more than 10 years. Seven (37%) of the respondents had held the same position for more than 10 years; another seven (37%) had been in the same position for 6-10 years and the remaining five (26%) had worked for 2-5 years in the same position. The majority of respondents (74%) have worked for more than five years, reflecting considerable range of professional experience and knowledge of changes in library services and technology. Because of the current trend of rapid technological developments, even librarians with less than five years of work experience augurs familiarity with emerging technologies and a variety of changes in the profession. Work experience of respondents is reflected in Figure 4.2:

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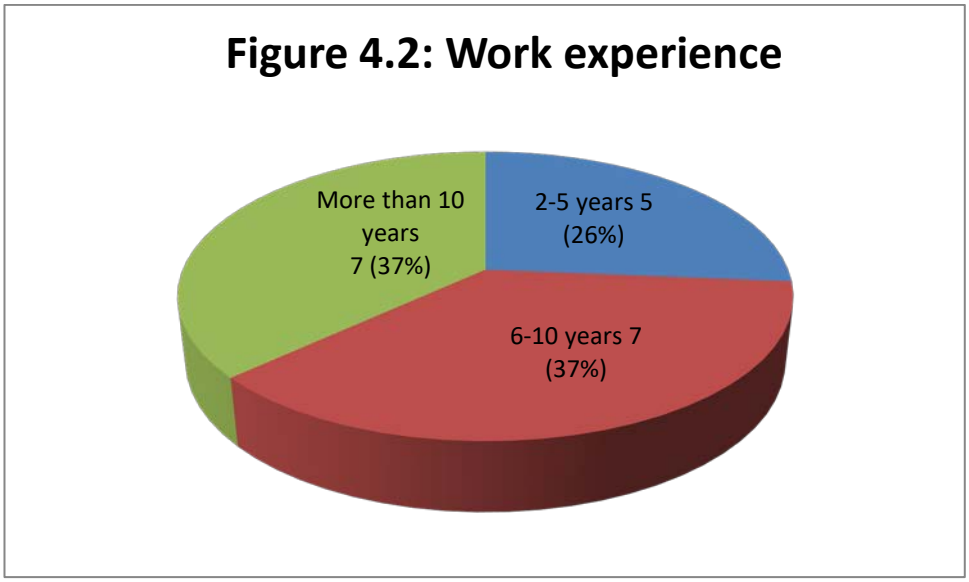

4.2.1.3 Age range

Respondents were provided with following categories to select age range: 20-30, 31-40, 41-50 and older than 50. Figure 4.3 presents the age range of the respondents in a chart reflecting that five (26%) librarians were over 50 years old, ten (53%) librarians were between 40-50 years of age and four (21%) librarians were between 30-39 years of age. The librarians ranged from baby boomers to millennials. "Millennials are bringing technology from their personal lives and using it as solutions to their workplace needs" (Blackburn, 2011: 664). Millennials may influence older colleagues to adopt new technologies because as they have embraced technologies from an early age in their personal and professional lives. The millennials may not have the authority to make decisions for the entire library, but they can help persuade those around them regarding the use of the technology because of their familiarity with it (Blackburn, 2011: 673).

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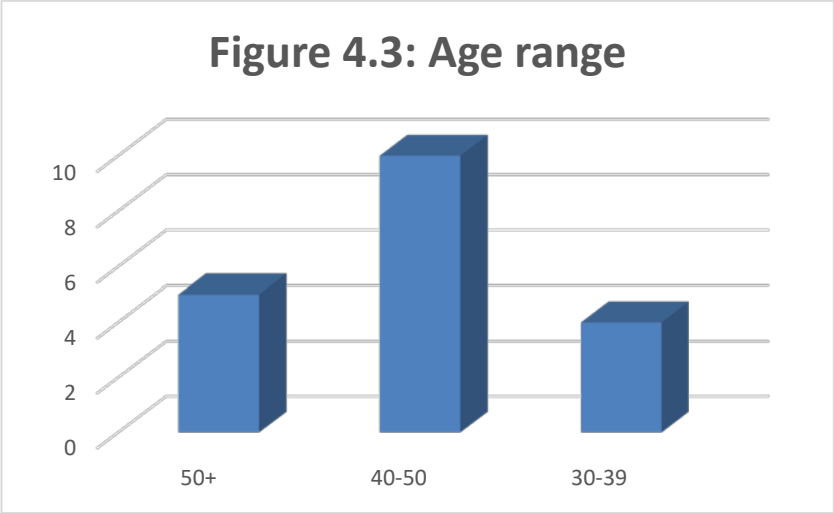

4.2.1.4 Gender

This item deals with the gender of the respondents. Figure 4.4 presents the answers in the form of a pie chart. Sixteen (84%) respondents were female and three (16%) were male resulting in a ratio of 1 male for every 5.3 females. These proportions relatively correspond with the demographics at the four libraries as the total subject or faculty librarians employed at the time of the study by the four institutions were fifty seven females and seven males resulting in a ratio of 1 male for every 8.1 females.

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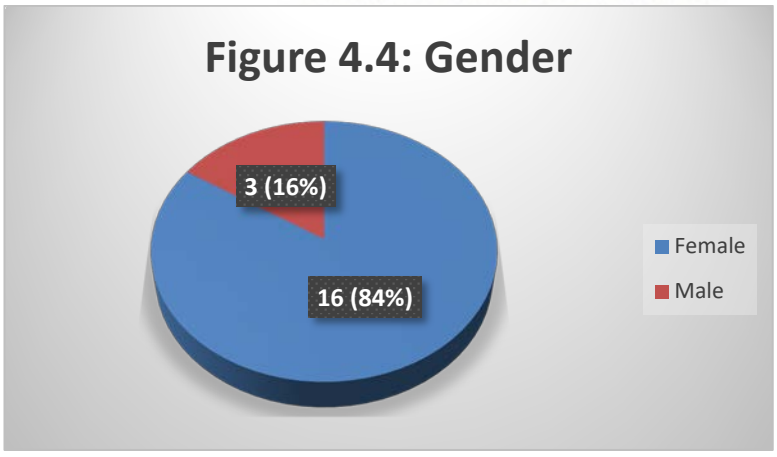

4.2.1.5 Highest qualification

This item required the highest qualification obtained by respondents. Table 4.1 shows that five respondents had a Master's degree and eight had an Honours degree. One respondent had a postgraduate qualification in Psychology while eleven had

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Masters or Honors degrees in Library Studies. Three librarians had a four year degree in Library and Information Science (B.BIBL); two had a Bachelor in other fields plus a Postgraduate Diploma in Library and Information Studies (PGDipLIS). One librarian held a post graduate diploma in Archives and Records Management. All librarians partaking in the study were well qualified with the majority in possession of postgraduate degrees.

Table 4.1: Qualifications		
Highest qualification	**Number of respondents**	**% respondents**
Masters	5	26.3%
Honours	8	42.1%
PGDipLIS	2	10.5 %
B. Bibl	3	15.8%
Archive & Records Management	1	5.2%
Total	19	100%

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4.2.1.6 Current studies

Respondents were asked if they were studying at present, and, if that was the case, what was the envisage qualification. Table 4.2 shows that one respondent was studying for a Master's degree in Library Studies, two were doing MPhil degrees and another was studying Private Law. Six were not studying anything, eight did not give any information about their current studies and one did not respond at all. The fact that five of the respondents were at the time of the study busy with studies was an indication that librarians want to learn to equip themselves with knowledge and skills to perform better in their workplaces.

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Table 4.2: Currently studying		
Qualification	**Number of respondents**	**% respondents**
Masters in Library Studies	1	5.2%
MPhil	2	10.5%
Private Law	1	5.2%
Not specified	8	42.1%
No response	1	5.2%
Not studying	6	31.6%
Total	19	100%

4.2.2 Section B: Use of technologies

The second section of the questionnaire dealt with the technology devices and the applications that the subject or faculty librarians were currently using at work.

4.2.2.1 Technology devices

Librarians were required to select from a list which technology devices they have used in the last two years. The options were: e-Reader, iPad/Tablet, Laptop or Smartphone. The respondents could select more than one device. The respondents were also asked how often they used them. The choice was either “always”, “sometimes”, “hardly” or “never”. Eight librarians had “never” used e-Readers; one was “always” using one; five “sometimes” used an e-Reader; two “hardly” ever used one while three did not offer a response. Ten librarians “sometimes” used an iPad; two were “always” using one; three “hardly” ever used one; three had “never” used one and one did not give a response. Fourteen librarians were “always” using a laptop and five used one “sometimes”. Eight librarians were “always” on a smartphone; seven were “sometimes” and two were “hardly” ever on a smartphone. One had “never” used a smartphone and one did not reply. The frequency of technological device used is reflected in Table 4.3.

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Table 4.3:Technological devices used						
Device	**Frequency of use**					
	Always	**Sometimes**	**Hardly**	**Never**	**No response**	**Total**
e-Reader	1 (5.2%)	5 (26.5%)	2 (10.5%)	8 (42.1)	3 (15.7%)	19
iPad/Tablet	2 (10.5%)	10 (52.6%)	3 (15.7%)	3 (15.7%)	1 (5.2%)	19
Laptop	14 (73.6%)	5 (26.5%)	0	0	0	19
Smartphone	8 (42.1%)	7 (36.8%)	2 (10.5%)	1 (5.2%)	1 (5.2%)	19

From Table 4.3 it can be seen that the majority of Calico subject librarians used laptops, smartphones and tablets either always or sometimes. The use of mobile devices corresponds with studies by Blackburn (2011), Gladsby and Qian (2012), McCabe and MacDonald (2011) as well as Sharman (2012) that librarians are prepared to use devices that will enable them to offer roaming virtual services.

Other devices used

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The eighth question asked librarians to list any other devices used that did not appear on the list. Four librarians listed a desktop personal computer and one librarian added an Android phone.

4.2.2.2 Technology applications used

Respondents were provided a list of technological applications from which they could indicate which technological applications they were using and then rate their competency against a Likert rating scale, from excellent (1) to poor (5). The librarians could select more than one application. With regards to the mastery of bibliographic management tools, nine librarians rated their competency as "excellent"; six as "very good", three as "good" and one as "fair". Seven librarians thought their skills with citation analysis tools were "excellent", eight said they

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were “very good”, two, that they were “good” and one as “fair”. One librarian did not respond. In the case of eBooks, eight librarians felt they were “excellent”, seven as “very good”, three as “good” and one as “fair”. Four librarians described their use of online collaboration tools as “excellent”; five librarians said it was “very good”; five others, as “good” and three as “fair”. Two librarians had never used these tools. In the case of open source repositories, four librarians rated themselves as “excellent”; seven as “very good”, and eight others as “good”. One librarian indicated his or her use of QR Codes was “excellent”; seven librarians indicated it was “good”; three gave themselves a “fair”. Six librarians had never used QR Codes and two did not respond. Six respondents were “very good” at using recorded tutorials; three said they were “good”; five felt their competency was “fair”; three have never used them and two did not respond. Sixteen librarians made “good” use of social media networks, two had never used them and one did not respond. One librarian made “very good” use of 3D printers; one rated him or herself as fairly competent while the 16 others had never used a 3D printer. The levels of competency in using technological applications are displayed in Figure 4.5:

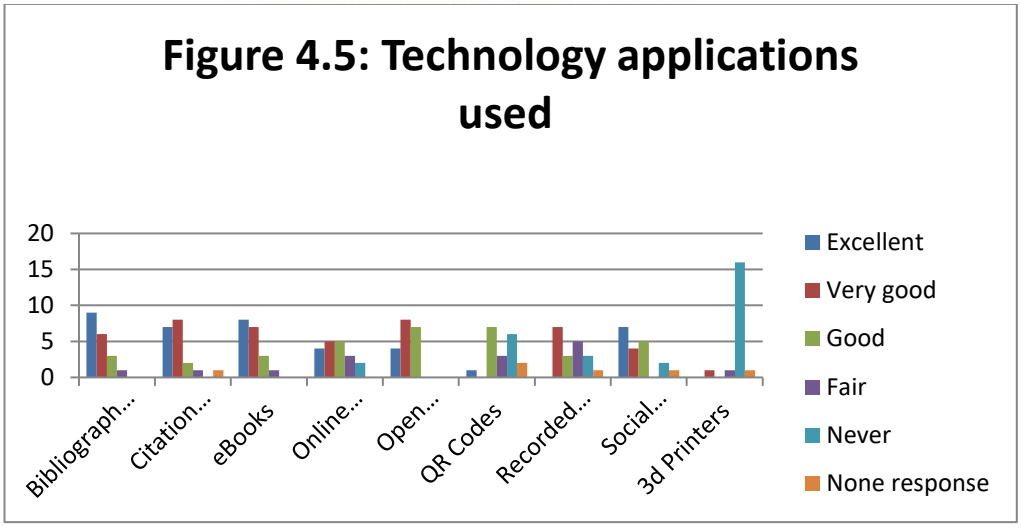

Figure 4.5 reflect that the majority of librarians (73%) rated themselves as excellent, very good or good at using the listed technological applications. Seventeen percent indicated the non-use of listed technological applications. This result corresponds

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with studies in the literature that librarians are willing to embrace technological applications.

Other technological applications used

Respondents were asked to indicate any other type of technological applications that they made use of. Table 4.4 presents the responses. One librarian mentioned Pinterest, LibAnswers, LinkedIn and Academia.edu; another mentioned LibGuides and Blackboard; one used ResearchGate and Academia. Six librarians said that they did not use any other applications. Seven librarians did not respond. The fact that six additional applications were identified was an indication that librarians were trying to stay up to date with new developments.

Table 4.4: Other applications		
Application	**Number of respondents**	**% of respondents**
Academia	2	10.5%
Blackboard	1	5.2%
LibAnswers	1	5.2%
LibGuides	1	5.2%
ResearchGate	1	5.2%
No other applications used	6	31.5%
No response	7	36.8%
Total	19	100%

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4.2.2.3 Services into which emerging technologies had been integrated

Respondents had to indicate which services had benefitted from the integration of the new technologies. The options provided were: Circulation, Marketing, Reference, Research and Technical services. The librarians could select more than one option and were also asked to add services that were not listed. Seventeen librarians reported that these technologies had been integrated into the Research

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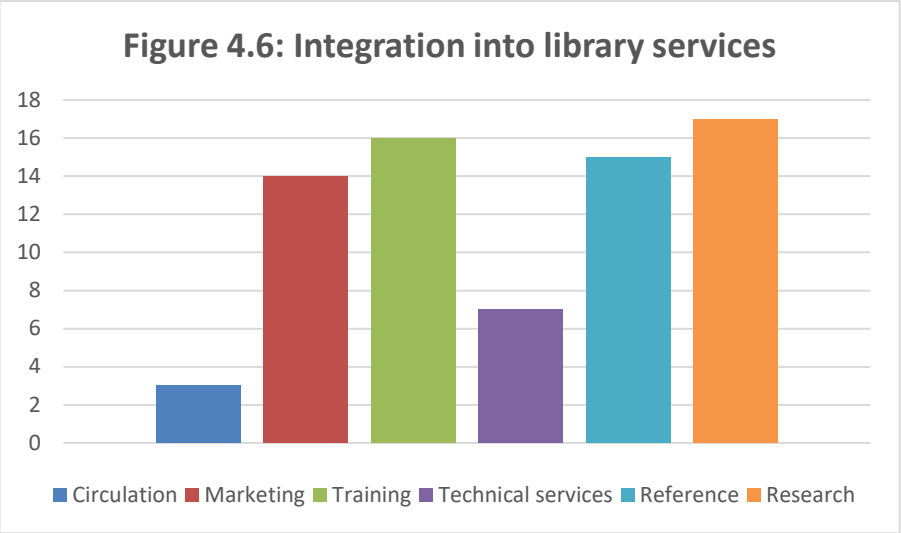
services; sixteen mentioned training services; fifteen had chosen Reference services; thirteen selected Marketing services; seven mentioned Technical services and three chose Circulation. Figure 4.6 present the responses to Question 11.



The responses indicate that emerging technologies have been implemented mostly into research, training, reference and marketing services. The high rate of using technologies to supply research support corresponds with conclusions by scholars like Alam (2014), Chiware and Mathe (2015), Raju and Schoombe (2013), Van Wyk nd Van der Walt (2014) as well as Yang and Li (2016) that academic librarians are rendering research support services by making use of various software applications. The low rate regarding circulation corresponds with findings of Hussong-Christian, Nichols, Bridges and Lajorie (2013) as well as Zinn and Langdown (2011) that the use of e-books is gradually.

4.2.2.4 Details of the specific technologies which had been integrated into certain services

Respondents provided more information about specific emerging technologies which had been integrated into the services mentioned in 4.2.2.3. Several respondents referred to the use of marketing videos and social media networks

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(Facebook, Twitter, Pinterest) which were now integral to the marketing of library services and of communicating with students. This information confirms the opinion of Jain (2013: 5) that social media provide more opportunities for reaching the user community, at large and for targeting specific audiences and that it also gives users a place or space where they can interact with the librarians and other library staff. Two respondents mentioned that Twitter was used to market research output as well. Three respondents used an open source repository, DSpace. One respondent used LibAnswers for online reference. Three librarians found smartphones or tablets very useful when they were helping clients or doing training while there were load shedding or "dead" desktop personal computers due to power outage. Two respondents mentioned the value of online collaboration tools like Google Docs in facilitating the sharing of reading material among members of interest groups. Two respondents also mentioned that they used Mendeley to share information with groups of users and to export and import documents. Their sentiments reflect findings of studies by Diffin, Coogan and Fu (2013), Tolley-Stokes (2011) and Yang and Li (2016). In conformity with scholars like Bailey (2012) Small (2010), Visser (2013), four respondents mentioned the use of recorded tutorials in blended learning. Table 4.5 summarizes the data about the integration of the new technologies into various services:

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Table 4.5: Integration into library services	
Services	**Technologies**
Marketing	*Use of Facebook, Twitter, Pinterest to market products and events in the library.*
	Marketing videos were created, e.g. FYE videos for first years, orientation videos
	Social media is used for marketing library services and creating awareness of library offerings to researchers.
	Twitter for news and notices
Training	*Recorded tutorials for training of students.*
	Using recorded tutorials for blended learning.

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	Using online tutorials (Self learning Zone), Statigo
	Training videos were created, e.g. FYE videos for first years, orientation videos, information literacy video clips that explain concepts and jargon, with examples.
	The aim of the tablet teaching method, was that class sessions will be practical and hands-on, that students will be required to access preparatory slides on Blackboard.
	Use of tablet/smartphone to take photographs which will be used in training programs and marketing material.
Research	*Using Twitter to improve faculty altmetrics in research output articles*
	Continuous use of citation analyses.
	Using Twitter to post new research output from Faculty
	Research - Scholarly communication.
	Mendeley is used in training sessions and to share information within groups.
	Open source repository, DSpace, is linked to ORCID, as well as to national e-TD's.
	DSpace, Repository
	Other technologies, such as, the open source repository were used for research purposes.
	Databases, e.g. bibliographic management tools are integrated into subscription databases. Mendeley has an auto-save option and can export and import.
	Google Docs for sharing reading material within specialist groups.
	Google Docs for sharing documents with students
	Archive research output
Reference	*use of LibAnswers*
	Using a smartphone or tablet to help clients when there is load shedding or when visiting departments

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Technical	*System is used to track items in library collection, place orders for library materials, pay bills, and patrons who have borrowed.*

4.2.3 Section C: Perceptions on adoption and use of technologies

This section investigated the librarians' views about the adoption and use of the new technologies.

4.2.3.1 Advantages experienced after adopting technologies

Question thirteen asked participants to explain what advantages resulted from adopting a specific technology. The respondents gave a range of advantages which were coded and four themes were identified, namely ease of use, point of need, blended learning and scholarly communication.

Six librarians mentioned ease of use while six others pointed out the importance of scholarly communication and how technology can support research, especially, in improving access to research output. Another advantage is that academics at the universities are able to contact researchers, anywhere in the world, who are working in the same field in order to promote collaboration and sharing, and expose them to different perspectives. Four librarians indicated that it addressed different learning preferences to enhance teaching and learning. Four others said that they could reach out to clients speedily. Table 4.6 presents the responses regarding advantages experienced:

Table 4.6: Advantages experienced after adoption	
Categories	**Responses**
Ease of use	*Easy to use, but not all clients have access to certain technologies, i.e., QR Codes need Smartphones*
	Easier to learn for students.

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	I personally love technology and social media, so I appreciate the advantages…such as easy access, easiness in learning,
	Easier to learn for students.
	Most of the students are excited, as these makes [sic] their lives easier, e.g. one e-book title can be accessed by multiple users at once, …[similarly, a] bibliographic tool where they like the idea of keeping all there sources into [sic] one platform etc.
	Make[s] life easier
Point of need	*Great outreach; [can] reach students in their own environment*
	Quicker turn-around time for delivering services
	Advantage to distance students
	Access - anywhere, anytime; minimal data required
Blended learning	*More embedded in Faculty*
	Make blended learning, more easy [sic] to integrate
	Students searching skills improved *Students learn to work independently* *They participated actively in class*
	In [a] format that relates to current student demographic *saves a lot of talking time in the class* *able to address different learning preferences* *able to address language barriers* *able to address students with learning/physical disabilities*
Scholarly communication	*Makes things easy for staff, e.g., with repositories, more people can get access, easily, to research output.* *Through scholarly communication, researcher can communicate …[with the] broader community*

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	Ease of communication with researchers. Information is easily and readily available to researchers.
	Good experience in enhancing teaching and learning. Emerging technologies open doors to open access.
	Altmetrics … improved by Twitter
	Question 2.3 is very relevant in today's academic research environment. Our researchers and [postgraduate] students need to know or be made aware of the variety of tools at their disposal and the value they can add to the work.
	Greater collaboration and sharing, meet librarians from different parts of the world.

This matches the concept of relative advantage in the Diffusion of Innovations (DoI) Theory, namely, the improvement that follows from the successful adoption of an innovation. This is also consistent with the views of Kajewski (2007: 420) on enhancing library services and that new technologies allow libraries to give their users what they want, when they want it and how they want it. Three respondents spoke about the advantages of blended learning by utilizing online tutorials to coincide with findings of Bailey (2012) and Visser (2013)

4.2.3.2 Disadvantages experienced after adopting emerging technologies

This item probed whether there were any disadvantages following the adopting the new technologies. Four respondents didn't present any disadvantages. The responses received were coded and classified as disadvantages because of connectivity, time consuming, information overload, maintenance, compatibility and reluctance to use. Table 4.7 displays disadvantages experienced by respondents:

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Table 4.7: Disadvantages experienced after adoption	
Categories	**Responses**
Connectivity	*Internet access was a challenge*
	Very little [,] like when the [re] was [a] power failure or when the server is down.
	Network connection
	Poor connectivity
	Poor connectivity and lack of resources
	Not all the users have access to electronic devices, e.g. no internet at home.
	Students had no logins
Time consuming	*Speed to keep up*
	Yes, I felt like I needed to be "connected' all the time, which leads to stress...Fear of Missing Out...
	There are so many technologies available, so you need to investigate the most suitable ones, and this is time consuming. As you get to know the one, there are newer ones on the market.
	[Preparation] and training sessions were time consuming
	Not always easy to get enough time for training, [in the case of] both staff and the users
Information overload	*Yes, information overload*
Maintenance	*Failing systems*
	Improper planning can lead to disaster
	Expensive to maintain. *Unreliable.*
	Not always easy to maintain these technologies; this is also due to lack of funding
Compatibility	*Tablet not compatible with the apps used in Information Literacy*

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Reluctance to use	*Some colleagues struggle with technologies, as well as, some older students.*
	Staff were reluctant to adapt to these changes

The majority of respondents (seven) identified problems with connectivity as a disadvantage. The fact that was time consuming to experiment with new technologies was mentioned by five librarians. Interestingly two librarians recognized what some colleagues and students struggled using technology and some were reluctant to adapt.

The most disadvantages seemed to reflect challenge of learning something new. This is explained by the concept of relative complexity in Rogers's (1995: 242) theory of DOI. An innovation that is easy to use is likely to be adopted more quickly than an innovation that requires the learning of a new skill and understanding.

4.2.3.3 Compatibility of emerging technologies with existing library services

Respondents were asked to express their view on whether any or all the emerging technologies were compatible with the existing library services. Librarians' responses varied. Thirteen respondents stated that some, not all, emerging technologies were compatibly to existing library services. They further stated that they believed that only those technologies that were compatible were chosen. This fits in with the DOI theory that holds that the speed at which an innovation is adopted will depend on how well it meshes with existing values, past experience and needs of adopters (Rogers, 1995: 224). For example, the change from a card catalogue to an online one did not affect the principle only the format. Table 4.8 presents the respondents' views about the compatibility of the new technologies:

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Table 4.8: Compatibility of technologies adopted	
Compatible	**Not compatible**
Very compatible. It took some time … [before] everyone had adapted. But once understood the skills were learned quite fast.	*Not all are compatible, hence we are investigating … [a] 21st century cloud-based library solution*
They are compatible	*Not that compatible, some apps are not available e.g.Worldle.net*
The only thing new about new technologies is the format in which … [they come] or in which … [they are] used. The general idea is exactly the same. For example, the card catalogue vs the online catalogue. The core principles are the same, but the format is different, therefore, some training is required in order to use these new systems.	*I found it relatively compatible, but then [I] stay within the context of the library online profile, the CPUT student profile and [the] availability of support structures within [the] CPUT IT department, when making decisions for use. Also, the planning and background investigation … [are] crucial for success.*
Mobile technologies integrated with no problems	
Most technologies are very compatible. I think that we choose those [technologies] who are compatible and stay clear from those [technologies] who are not. Library services and IT are continuously striving to make services easier and ensuring that services are compatible.	
Somewhat compatible	
No problem to integrate	

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Library services and IT are continuously striving to make services easier and ensure that services are compatible.	
The ones we used were free, not really [experienced] problems	
The adopted technologies improved the library services tremendously.	
They make the library services seamless.	
With the library website already in existence, it was easy to integrate social media and the open source repository into it.	
With the emerging technologies, information is easily accessible, and it's more time saving, e.g., before DSpace was used, thesis were available in hard copies, which took time to be processed, and to be located on shelves	

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4.2.3.4. Trial before implementing

Respondents were asked whether they have experimented with any of the emerging technologies before implementing them. The researcher wanted to determine if there was a common practice. Thirteen said that they had trialed some before implementing them. Five respondents did not try any out and one did not respond.

4.2.3.4.1 Methods of trialing

When respondents were asked to explain how they carried out trials. Responses received were coded and classified as personal use, training, watching videos and other methods. The most (five) respondents had made personal use of an emerging technology before using it at work, while two indicated that they received training through working groups and workshops. Two respondents mentioned that they

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experimented with YouTube videos in order to incorporate them into their teaching of student groups. Table 4.9 displays methods used by respondents to trail technologies:

Table 4.9: Trialing	
Method of trial	**Responses**
Personal use	*I tried to use Twitter for [my] personal use b4 I could use it for work purposes*
	Bought an own device, downloaded software, tested and used it.
	I first try it out on my own. For example, I had my personal Twitter page before I decided to use it in my work.
	Mendeley attempted the free course and was satisfied, and, therefore, promoted the product to the students
	Google Drive is not yet implemented at our institution, but I am already using it to share documents with colleagues.
Training	*We create[d] a Working Group, which were given time to test new technologies. We give feedback. We trial it with a select group of staff and students. We do feedback. If relevant then we go live.*
	Went through workshops and hands-on training before rolling out to students.
Watching videos	*I watched a lot of YouTube videos, spoke to media, MIS and MCD staff, [I] investigated how it could be applied on a small scale within the context of library services. Then had ad hoc discussions with students, where I explained the idea. They often clarified their needs for me and I was able to build it into the plan.* *Then I created assignment based IL videos and tested it on my class and their lecturer. Received their input and applied it to the next video.*

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Other	*Promote trial access to faculties*
	My department encourages us to. There is always something on trial. Our library is trying to keep up with the latest technological trends.
	Benchmarking to see what works best.

The DOI theory maintains that an innovation that is easy to experiment with or test is more likely to be adopted (Rogers, 1995: 244). Hussong-Christian et al. (2013) agree with Rogers (1995) that trialing a new technology is important, for it is a good test of seeing if will fit individual needs and enhance library services.

4.2.3.4.2 No trialing

This item solicited reasons why respondents were not able to experiment with emerging technologies. It seemed that most respondents were not given the opportunity to trial before technologies were implemented. The responses were:

- *"No time and only computer labs [are] used"*
- *"Not exposed in[to] these trends"*
- *"Just started using the tools"*
- *"Our institution started implementing the emerging technologies later than some other institutions. I think the reason for not experimenting might be that they had already seen how they work somewhere else"*
- *"No consultation before implementation"*

Failure to trial denies users of the opportunity to see the benefits for themselves. Ibrahim, Ezra and Monsurat (2015) stated that, if users miss trialing, they lose the opportunity to modify the innovation to suit their own requirements.

4.2.3.5 Difficulties experienced when implementing

Librarians asked if they had any difficulties when trying to understand and use some of the innovative technologies in order to implement them. Rogers (1995: 242)

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declared that “an innovation can be classified by individuals as either complex or simple to adopt”. The responses on difficulties experienced received were coded and classified as IT support, compatibility, management support, connectivity, lack of communication, attitudes and usage. Many of these difficulties confirmed the disadvantages experienced after adopting emerging technologies as discussed in section 4.2.3.2.

Three librarians were unhappy about the lack of IT support. Two others mentioned difficulties which arose from the incompatibility of the hardware and software - this complaint can be linked to the responses which mentioned earlier about the lack of IT support. One librarian stated that communication between the various sections of the university, which were involved in implementing technologies (for example the IT department), was inadequate. Three respondents referred to a lack of managerial support and two librarians complained of poor connectivity. Five others mentioned that certain colleagues, older students and some academic staff were reluctant to use the new technologies. This corresponds with the identified disadvantages experienced ‘reluctance to use’ mentioned earlier. Two respondents felt that some of the technologies were not easy to use.

It should be noted that one librarian indicated that because no training was provided, library staff members trained themselves. They had learned by trial and error. This links with responses in the previous section where some librarians acknowledged to first using an emerging technology in their personal capacity before they then used it at work. Kajewski (2007) has emphasized that training is important if implementation is to be successful and that it can be done inexpensively. Aharony (2013) has pointed out the necessity of convincing workers who expressed a reluctance to use a new technology by demonstrating its advantages when providing training. Table 4.10 displays responses regarding complexities as expressed by respondents:

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Table 4.10: Difficulties experienced	
Categories	**Responses**
IT support	*Lack of IT support*
	LICT does that for the Library
	Maintenance
Compatibility	*[In]compatibility between hardware and software.*
	It becomes a challenge when the systems are not compatible.
Management support	*[Support] from the management*
	We can't just implement new technology; the managers need to… [approve]… it.
	No funds available to purchase a device
Connectivity	*In most cases its poor connectivity.*
	It generally takes a bit of time. The instability of the internet sometimes causes a problem in production. The tools I needed, I've had to argue for.
Lack of communication	*The initial difficulties were caused by lack of proper communication between sections that were involved in implementing the emerging technologies.*
Attitudes	*Being new devices or applications, wrapping one's mind around the complexities of systems is the biggest challenge.*
	Some colleagues are hesitant to use emerging technologies. Older students and academic staff sometimes prefer conventional methods.
	Inconsistency and resistance to change
	No proper training is given, people must train themselves, by practicing … [on their own].
	Not really any difficulties per se, just need to familiarize yourself with the new technologies
Use	*Not all of them are easy to adopt*

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	Emerging technologies are a dime a dozen. There needs to be discernment when selecting which technologies are good enough to adopt.

4.2.3.6 Easiness of use

Respondents were asked to express their views on the statement "emerging technologies are easy to use". Interestingly seven of the respondents responded positively by indicating that technologies were easy to use, while another seven was negative indicating difficulty to use. Six librarians were ambivalent. An example was one respondent statement that this is "not always [the case], [it also] depends on the software and compatibility". Most of the responses indicating that technologies were not easy to use, qualified their responses. An example of the latter was "once it is understood, however, yes, then they are easy to use". This alerted to the challenge of learning something new. Rogers's concept, "relative complexity" (1995:242), explains this phenomenon. Table 4.11 presents respondents' views on the easiness of technology use.

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Table 4.11: Easiness of use	
Categories	**Responses**
Easy to use	*Yes, it is*
(7 responses)	*Agree*
	I would say they are easy to use, especially if [the]… interface is user friendly
	Since there are so many to choose from, there is always an alternative 'easy' option, I base my choice on the one that supports the goal I'm after. I then learn the technology. Some are easy, some are not.
	I agree, especially … the young[er] generation, the digital natives, they learn technology very quickly.

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	Yes, when you have someone to coach or work with when trying something you.
	Yes, it is
	Agree
Not easy **(7 responses)**	*Not necessarily, at the beginning. Once it is understood, however, yes, then they are easy to use. For me the challenge lies in the learning time.*
	Not all emerging technologies are easy to use.
	I don't think it's easy to use, if no training provided. Some students were not exposed to smartphones or these emerging technolog[ies]
	Not always. The motive … [for] acquiring them is to improve service. People who use them get to master them through practicing
	Not always, depends on the software and compatibility
	Not always
	I think it is only easy to use for those who embrace technology. If you are not tech savvy, it is difficult to use
Ambivalent **(6 responses)**	*Not sure about this view*
	It depends on the type of technology and what you are using for
	Depends who the client is and their willingness to learn.
	Need institutional support.
	I think it is only easy to use for those who embrace technology. If you are not tech savvy, it is difficult to use
	Depending on the technology.
	Some are complicated and some are easy. To keep all [the] password[s], it's a problem.

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4.2.3.7 Observing effective use of emerging technologies by library users

This item investigated whether the fact that these librarians (or anyone) who were seen using the emerging technologies influenced others. Respondents had to answer either 'yes' or 'no'. Seventeen librarians said 'yes'; one said 'no' and one didn't answer the question.

4.2.3.7.1 Ability to observe effective use by library users

Subsequently, librarians who answered the previous question positively, were asked to record what they observed. Although seventeen responses answered 'yes' only fifteen responses were received. Table 4.12 blow, presents responses on observing effective use. Responses on observing effective use of emerging technologies were either so different or too vague to coding. The categories LibGuides, social media, mobile technologies, bibliographic management tools, connectivity, training and general were identified.

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Table 4.12 Observing effective use of technologies	
LibGuides	*I have noticed that Libguides are used via mobile phones*
	Academic staff has noticed my Twitter page and started following me…
	I had a session with MTECH students and unfortunately could not do the hands-on training with them regarding Mendeley. I referred them to our LibGuide and took them through the steps…
Social media	*To be able to use social media as fast and effectively as students do gives them the advantage to ask and share…*
Mobile technologies	*Applications of mobile technologies by students…*
	Use of laptops, cell phones, has resulted in the request from users that added services be made available via the mobile app…

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Bibliographic management tools	*Users are searching and exporting references from subscription databases to a bibliographic manager like RefWorks or Mendeley and are inserting in-text references using Mendeley or RefWorks, as well as generating reference lists…"*
Connectivity	*I find students use technologies with ease and as it is part of their university outfit. Logging on and the availability of Wi-Fi makes the usage so much easier.*
Training	*In training and marketing*
	Makes teaching and learning experiences easy…
General	*We are able to see how many people are using technologies, we are able to draw statistics and observe the numbers, and we get feedback from the users*
	Results and institutional/ client benefits…
	Most library users are always working with technology, anyway, so it is easy for them to use emerging technologies effectively, as soon as they are shown how…
	Library [staff] feel very empowered and tech-savvy when the new technology fulfills their expectations…
	Active participation of students and good collaboration from the Department as well as the library…
	Research support services

4.2.3.7.2 Non-ability to observe use by library users

Respondents who answered with a 'no', were asked to supply reasons for their answers. Only one responded reacted by stating that "*only the e-resources librarian can view the usage statistics*".

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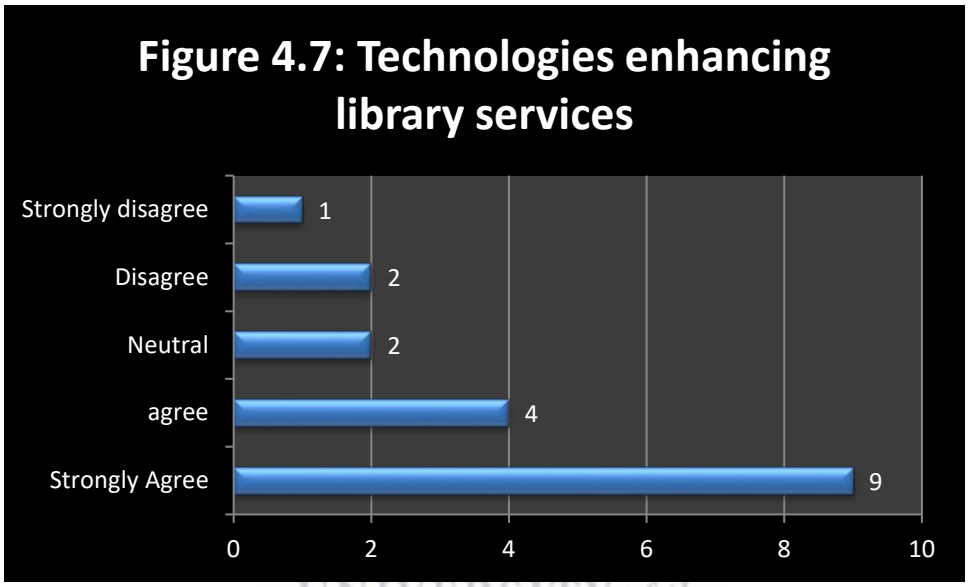
4.2.3.8 Enhancing the delivery of library services

The researcher asked the librarians to give their views about the claim that "Emerging technologies improve the delivery of library services". They were presented with a five point Likert Scale, the choice of responses ranged from 'strongly agree' (1) to 'strongly disagree' (5).

Their responses are shown in Figure 4.7:



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Nine librarians chose 'strongly agree' and four others selected 'agree'. Two chose 'neutral', two disagreed and one disagreed strongly. Most of the librarians (13) thought that emerging technologies enhanced the delivery of library services. This were consistent with their support for the idea that the adoption of emerging technologies had many advantages, and with the concept of relative advantage formulated in Rogers's (1995: 216) theory of DOI. Relative advantage describes the superiority of an innovation over the current arrangements.

4.2.3.9 Keeping up-to-date with emerging technologies

This item sought information about the ways that librarians keep up-to-date with emerging technologies. Some librarians mentioned more than one way. The responses received were as follows:

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- Nine librarians followed trends by reading library literature,
- Four librarians followed Twitter and blogs
- Three librarians subscribed to alerts and blogs,
- One librarian attended seminars and conferences,
- One librarian followed a listserv,
- One librarian networked and shared information and experiences with colleagues,
- One librarian stated that the library had employed staff to scan the environment for emerging technologies and inform others to keep up-to-date.

The responses reflected that respondents were willing to keep up to date with emerging technologies. The majority of librarians used relevant literature or various social media platforms to read about new developments.

4.2.3.10 General comments

The researcher invited general comments. Only eight librarians offered comments. Responses were categorized as embrace change, student involvement and innovation. Four librarians said that emerging technologies need to be embraced; one felt it was important that students should be involved when new technology is being tried out and a training program needs testing; two respondents advised caution when choosing an emerging technology and accommodating different users. Table 4.13 lists the comments.

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Table 4.13: General comments	
Categories	**Responses**
Embrace change	*I think it is here to stay and that, we as librarians should embrace changes. However, we should take into account that there are patrons who are not technologically savvy and we should accommodate all our users.*
	It is something that is real and something that is coming, because while we are sleeping the world is changing

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	It's not going to stop. We have to encompass this reality as it happens and when it happens
	I think a lot more emphasis should be put on emerging technologies. It would enhance the teaching and learning side, especially of library literacies. Furthermore, a lot more training of staff should happen, as well as the opportunity for students to borrow devices so that they are able to use emerging technologies.
Student involvement	*Whenever a student, a librarian or a lecturer wants to try out new technology, please involve students for training and invite the manufacturer for a demonstration and to train people who would be using the product*
Innovation	*I think it is a huge movement. One must try, however, to remain cognizant of the why, what and how of the directive and make choices within the scope of delivery.*
	We can say it is easy, but we cannot be sure about that. Service is not only for young people, we also have adults who don't believe in this technology.
	It can also refer to things that have been around for a while, but are used in new and creative ways in libraries. An example of this is IM reference. IM was around for a while before libraries started using it to help their patrons. Emerging technologies in the context of libraries can be any tool that is being used in a novel way to serve your users.

From the responses it was clear that the librarians in general are positive towards new technologies and the adoption thereof to enhance library services. The general consensus was that the advances in technology should be embraced to make rendering a user services easier.

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4.3 Interviews

This section continues the data analysis dealing with the data gathered from interviews. The interviews were conducted in order to gather more detailed and richer information about the use of new technologies which could enhance services in the Calico libraries. The researcher interviewed seven librarians who did not complete the questionnaire. The researcher began by asking for personal information the purpose being twofold, to contextualize the data and to create an informal atmosphere.

It was observed that one of the interviewees was male and the other six were females. The gender ratio (1:7) corresponded to an extent with the ratio (1:5.3) of the questionnaire respondents and almost hundred percent with the ratio (1:8.1) of the population.

4.3.1 Personal details

Three librarians worked at UCT, three at CPUT and two at UWC. Four respondents had worked as librarians for more than five years while three had worked as librarians for less than five years. This corresponded with data from the questionnaires which indicated that the majority of respondents had more than five years of experience working in libraries. Four librarians (57%) were busy studying: two for an MLIS, one for a Master's in Business Information Systems and one for the PGDipLIS. The trend to study was also reflected by 63% of the questionnaire respondents.

4.3.2 Devices used by librarians

The librarians were asked what devices they used at work. Librarians could name more than one device. Seven librarians (88%) used laptops, three mentioned smartphones (38%) and two (25%) had use of tablets. Again, this corresponds with finding recorded in Table 4.3 indicating the highest percentage of always using laptops (74%), Smartphones (42%) and iPad/tablets (11%).

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4.3.3 Technologies adopted in line of work

Table 4.14 summarizes the emerging technologies that the interviewees said they used at work. They were invited to mention more than one. The question was asked to discover technology applications in the librarians' line of work.

Table 4.14: Integration of technologies in services

Service	Technology	Number of librarians
Bibliographic management tools	RefWorks	2
	Mendeley	1
	Google Scholar	1
Open Access Journal publishing	Open management	1
Marketing or Communication	Skype	1
	Facebook	2
	WhatsApp	2
	Twitter	1
Online reference service	Online chat rooms	1
	Chatra	1
Learning Management Systems (LMS)	Vula	1
	Ikamva	1
	Blackboard	3
Collaboration	Google Drive	3
	Dropbox	1
Online tutorials	Articulate	1
	Prezi	1
	Camtasia	1
	YouTube videos	1
	LibGuides	2

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The following technology applications were revealed:

One librarian used Google Scholar when he or she needed citation reports. Four librarians said that they used Google Drive when they collaborated with colleagues. Two librarians created Information Literacy tutorials on LibGuides. One librarian mentioned that Open management software was used for publishing books and conference proceedings by staff and students of the institution. One institution used Chatra, online chat software, to extend reference services to students who were off campus and to distance learners. Learning management systems, e.g. Vula, Blackboard and Ikamva, were used to upload guides that supported students in finding information, to upload summative assessment for Information Literacy. One institution created tutorial videos on Camtasia, the videos were linked to LibGuides. A librarian created quizzes on Articulate, a suite of e-learning software and authoring tools. These quizzes were used in training; they promoted learning, too, because students received feedback about their answers. Other training tools were YouTube videos and Prezi, a presentation software package. The presentations were uploaded onto LibGuides and other learning management systems so that students could access them at any time. Social networks, such as Facebook, Twitter and WhatsApp, were used to communicate with students. Some of the interviewees would do so using the tool favored by a particular academic department, especially when they wanted to tell students about training sessions, a case in point, two interviewees had used WhatsApp.

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These responses compare closely with responses of librarians who completed the questionnaire indicating technologies used and applications thereof, which includes research support, communication and marketing, online reference services, collaborations among librarians e-learning and training.

4.3.4 Factors influencing adoption

Responses on the question which factors influenced the adoption of an emerging technology, were:

"Change in terms of how the library is operated. Keep up in terms of meeting needs of users. Student use. Student Need..."

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"Convenience. Student Need. Render a service online for distance students…"

"Follow trends. Reach out to students - easier communicate outside campus…"

"Department uses Facebook…"

"The society has changed to be technologically advanced, so if one has to keep up in terms of meeting the needs of the user, then one has to keep up with the technologies…"

"Because students are using the stuff, and for us to reach the audience…"

"So what made me adapt to those, is to reach out to the users, to the people that I'm serving, who are so clued up …[on] the emerging technologies…"

From the responses a general trend that librarians adopted new technologies to reach out to the library users in order to satisfy their needs can be seen.

4.3.5 Impact of using emerging technologies

In response to the question on the impact on using emerging technologies interviewees alerted to recent changes in library services. The majority of librarians acknowledged the necessity of meeting student needs as the main factor behind the adoption of emerging technologies:

"Students are technologically advanced, if we're behind, we're not really serving student needs. Meet student expectations…"

"Reach out - to be where community is. Follow trends. Distance students - building relationships. Enhance services. In tune with users' needs…"

"Efficiency…"

"In tune with our users. Not to be left behind. Reach out to users…"

"Reach out to users…"

"Level communication with younger generation. Go to where students are…"

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These responses corresponded with the previous question as well as with the librarians who had completed the questionnaire indicating librarians recognizing that for user services to stay effective and essential, new technologies must be adopted and used.

4.3.6 Keeping up-to-date with new technological trends

After it was established that librarians adopted and used emerging technologies for the sake of keeping in line with user needs, a subsequent question on how interviewees kept up with rapidly changing technological trends was asked. A number of activities were mentioned:

"Kids show us. Refresher workshops…"

"Twitter (personal learning network). Follow websites; RSS Feeds…"

"Check websites…"

"Webinars. Follow other librarians…"

"RSS feeds. Follow innovative librarians…"

From the responses it was clear that the interviewees used own initiatives to stay up-to-date with emerging technologies by observing and learning from users, following discussions on social media like Twitter and RSS feeds and by partaking in workshops and webinars. This corresponded with actions recorded by the majority librarians who completed the questionnaires (4.2.3.9) indicating usage of social media platforms to keep up-to-date.

4.3.7 General comments

The interviewees were asked how they felt, generally speaking, about emerging technologies. From the responses it was clear that some interviewees found keeping up to date with emerging technologies time consuming and distracting them from other tasks. The general consensus was that the advances in technology were a reality that should be embraced to make rendering a user services easier. The

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importance of using the new technologies to communicate with students was a constant refrain. Alerting to possible compatibility issues was another issue recognized constantly by librarians. Their comments echoed those of the librarians who had completed the questionnaire where embracing technology, student involvement and innovation were identified:

"It impacts everything. Technology is here…"

"Time consuming. Librarians scan for ET…"

"Technology overload. Distracting…"

"Need time to respond constantly. Some tools are easy to use, others are not…"

"Why not adopt, if it makes life easier for us and our users…"

"Compatibility - adopt a technology to use for training, in lecture halls it can't work there.

"We should be using innovative ways to communicate with students. For an example, students use Voice notes to give opinions. I would consider using another form in the New Year. We need to go to where students are…"

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4.4 Library website analysis

The researcher scanned the websites of the four libraries in order to identify the various services and technologies used at each institution. The researcher was not always able to find particular services and technologies on the different websites. Some services were visible at a glance; for others the researcher had to click on specific links.

4.4.1 Social media networks

Social media networks were integrated into library services on all four library websites. Facebook was used to communicate with users and announce library activities and services. All the libraries marketed their services and events on Twitter. A collection of training videos on YouTube - most of them demonstrating

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how to use various library resources - was created by all four libraries. LinkedIn encouraged researchers to network with other professionals. Photograph collections of library events were found on Flickr and Instagram. It can be concluded that all Calico libraries using social media to marketing their resources and services. Details of the social media networks are listed in Table 4.15:

Table 4.15: Social media networks in library websites	
Social networks	**Number of institutions**
Facebook	4
LinkedIn	4
YouTube	4
Twitter	3
Pinterest	1
Blog	1
Flickr	1
Instagram	1

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4.4.2 Academic social networks

All the library websites encouraged researchers to use the academic social networks as a means of promoting the impact of their research and to increase visibility. The academic social networks identified by Palmer & Strickland (2017) provide an online repository where users can upload and share research papers. They provide academics with a place where they can connect with the researchers internationally as well as view analytics indicating how often their publications had been read or cited. The researcher found information and advice about the following academic social networks on the websites of all four libraries:

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Table 4.16: Academic networks observed in websites	
Social networks	**Number of institutions in which mentioned**
Academia.edu	4
Mendeley	4
ResearchGate	4

4.4.3 e-Books

The researcher saw e-book platforms on the websites of all the libraries. Some platforms were multi-disciplinary, others were subject specific. Although library catalogues retrieve available e-books, as many library users are not familiar yet with e-books, it is important to draw their attention to additional resources in electronic format.

4.4.4 Online tutorials

Two library home pages had links to videos, presentations and library quizzes on using various library resources. The third library's homepage reflected a self-learning zone described as "a directory of online learning material" offering videos and presentations on how to use the library. The fourth library's website had no training videos and presentations. All four library homepages had however links to many LibGuides which described information resources and explained how to use them.

4.4.5 Online reference services

Two library websites had links to 'Ask a librarian', an online reference service. Users could submit a question and receive an answer by email. Library users could also search a knowledge bank of questions and answers.

4.4.6 Bibliographic management tools

Table 4.17 reflects that bibliographic management tools were available on three library homepages. These reference management tools are also embedded in the

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catalogues of all the libraries allowing user to, after retrieving needed resources, store and manage references and creating reference lists. It can be deducted that the Calico libraries are assisting students and academic in academic writing.

Table 4.17: Reference management	
Tools	**Number of institutions using**
RefWorks	3
Mendeley	3

4.4.7 Institutional repository (IR)

All four library homepages had links to institutional repositories. All the repositories used DSpace, open source software to manage the resources within the databases. The functions of the repositories were variously described as:

- *A Research repository that stores, distributes and displays digital copies of research output*
- *An Institutional repository that collects, preserve and distributes research output.*
- *An Open access institutional repository which makes available and digitally preserves the scholarly outputs.*
- *[The Repository]… offers a single connection point to various collections of primary resources as well as digital research output.*

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It is important to draw attention to repositories as research data and publications are not retrieved by the catalogue and databases. Users should be alerted to these valuable resources.

4.4.8 Tracking research impact

Three library homepages indicated that librarians could assist researchers in tracking the impact of their research outputs. One library had a LibGuide on suitable tools and instructions on how researchers could measure the impact of their

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research. Table 4.18 shows the various technologies employed to measure research impact at the four academic libraries:

Table 4.18: Technologies measuring research impact	
Technology	**Number of institutions using**
Web of Science	2
Scopus	4
Google Scholar	4
Publish or Perish	2

4.4.9 ORCID

All four library homepages had a link to ORCID, an international, interdisciplinary non-profit organization which maintains a central registry of unique, persistent identifiers for individual researchers. Researchers associated with the institutions are therefor able to identify and verify details of researchers in a specific field.

4.4.10 Open Access

Each of the four library websites had links to their institution's Open Access policy. The researcher was able to identify various Open Access activities on the libraries' websites, for example, publishing activities and resources.

4.4.10.1 Open Access Publishing

Three library websites had links to the Open Journal System which libraries use to publish open access journals articles. One library website indicated that publishing of open access articles was a collaborative effort between the library, academic departments and other units affiliated to the university. Another library website had a link to Open Access conference proceedings hosted by the university. It can therefore be deducted that the Calico libraries aim to make visible the open access journal articles which library users may access and use without paying.

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4.4.10.2 Open Access resources

All four library websites displayed LibGuides with links to free e-textbooks and open access journals. If can be deducted that it is general practice that Calico libraries compiled lists of databases offering free e-textbooks and open access journals and published the lists on appropriate LibGuides.

4.4.11 Research Data Management (RDM)

The websites of the four CALICO libraries showed the differing ways that each library managed research data. Library 1's website had links to the institution's RDM policy and information on Intellectual Property Rights. There was also a link to a data management plan (DMP), an online resource that assists researchers in creating data management plans.

Library 2's website stated that library staff could assist researchers in organizing, managing, curating and sharing their research data. It also emphasized the importance of preserving research data, so that it is easily accessible now and in the future. The homepage also provided links to the DMP, to drafts of the RDM and to the Intellectual Property Rights policy.

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Library 3's website carried a brief statement indicating that the "management and retention of research data is currently under investigation".

There was no mention of RDM services on Library 4's website.

From this it can be concluded that perhaps because research data management is still a relatively new initiative, some libraries had not yet developed policies fully and were in the process of establishing this important academic library service.

4.5 Summary

This chapter presented an analysis of the data about the adoption and use of technologies to enhance four CALICO libraries user services collected by means of a web-based questionnaire, face-to-face interviews and by scrutinizing the websites of the libraries. The interpretation of the data was based on Rogers's (1995) theory of DOI and insights from literature on adoption of technologies in academic

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libraries. User and research support services of the CALICO academic libraries have incorporated various technological developments, though the degree of integration and the impact of such developments vary from library to library. Though a relatively small number of librarians were hesitant about adopting new technologies, a reasonable number of librarians were well aware that emerging technologies and users' evolving demands must be accommodated in order for an academic library to remain relevant. Library services must adapt and transform to meet the needs of 21st century students and scholars. Most recent integration had occurred in the areas of training and research, followed by reference services and marketing. Circulation and technical services showed the least technological innovation.

The next chapter will draw conclusions in relation to the identified research objectives and research questions.

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Chapter 5

CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter concludes with a critical assessment of the findings in answering to the research questions. It also includes recommendations and suggestions regarding future investigations.

The study investigated which new technologies the academic libraries in the CALICO had adopted to improve their user services. Special emphasis was on emerging technologies and innovation in library services. The research questions stated in the first chapter were:

- What emerging technologies have been adopted by the CALICO libraries?
- What are the advantages of adopting emerging technologies?
- Did the use of emerging technologies change the delivery of library user services?
- Are the adopted technologies compatible to users' needs?

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5.2 What emerging technologies have been adopted by the CALICO libraries?

This study focused on new technologies in the context of technologies that are transforming the way information is accessed and used in academic libraries as well as with characteristics highlighted by Veletsianos (2010: 13) that includes:

- May or may not be new technologies
- Are evolving organisms that exist in a state of "coming into being"
- Go through hype cycles
- Are not fully understood, nor fully researched
- Are potentially disruptive but their potential is mostly unfulfilled

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Laptops were rated as the most used technology devices as the majority of subject or faculty librarians indicated. They also highlighted the use of tablets to assist during load shedding, training or during visits to academic departments.

Most of the respondents rated their competence in using bibliographic management tools, citation analysis, e-books, open sources and social media between "excellent" to "good". Librarians adopted academic social networks like ResearchGate, Mendeley and Academia. The majority of librarians has trialed emerging technologies by first using them in their personal capacity and then applied them at work. Institutional training was supplemented by watching instructional videos on new technological applications.

The new technologies were integrated with research, training, reference and marketing services of the libraries.

All four CALICO institutions had created institutional repositories to house their research output. They were all using ORCID, Scopus and Google Scholar to trace the impact of their research. Links to open access publishing, open access resources and research data management were displayed on the home pages of all four libraries. Two librarians mentioned that Twitter was used to post information about new research. Library websites revealed other technologies not mentioned by librarians encouraging researchers to use including Publish or Perish, Web of Science, Scopus and ORCID.

All four libraries had created Institutional repository based on DSpace. The research outputs of the institutions were made visible and were readily finable in these repositories. As libraries progress towards developing research data management services, institutional repositories are used to deposit, access and preserve research data. All four library websites had displayed links via LibGuides to free e-textbooks and open access journals. However the websites of three of the libraries had links to the Open journal systems. Open journal systems, an open source software used to publish books and conference proceedings produced by students and staff of the institution, was mentioned by one librarian. All four websites encouraged

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researchers to register a unique identification number on ORCID. Institutional repositories were accessible from the websites of the four libraries.

Social media was a new way of marketing the library and its services and communicating with users. All four libraries linked to or had a presence on Facebook, Twitter, Pinterest, YouTube, Skype, WhatsApp and LinkedIn. Although photograph collection technologies were not mentioned by librarians, Flickr and Instagram were visible from websites of two libraries. This is consistent with Chu and Du (2012: 72) view that social networking tools were perceived to be helpful in promoting library services and interacting with students.

The study revealed the use of Google drive and Google Docs for online collaboration. Four librarians explained to have used Google Docs to share reading material or documents and Google drive to collaborate with colleagues.

The respondents noted several technological applications that were adapted for teaching information literacy. YouTube, Camtasia, Articulate, Prezi, LibGuides, Blackboard, Ikamva, and Vula were used to create and upload training videos on student learning platforms. The libraries' websites revealed links to LibGuides, self-learning, YouTube videos, presentations and quizzes focusing on teaching users to use or search library resources.

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Three libraries provided virtual references by means of online chat applications for example, Chantra, LibAnswers and Online chat to students on as well as off campus.

The reference management tools RefWorks and Mendeley were used to enhance reference services and student training. Additionally, Mendeley was used to share research and collaborate with researchers internationally.

Mendeley was available on the websites of all four libraries while two library websites linked to RefWorks.

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5.3 What are the advantages of adopting emerging technologies?

Emerging technologies have brought many changes to the work of subject or faculty librarians resulting in dramatic shifts in academic library mission statements and strategies. Rogers's (1995) DOI theory points out how relative advantages can influence whether these new technologies are adopted or ignored. The advantages mentioned the most be librarians were ease of use and timely responses at the point of need.

Seven librarians supported the idea of ease of use, while five had some reservations, indication dependence on the type of technology or the client. Six librarians didn't believe that new technologies were always so easy to use. Raynard (2017) has explained different perceptions and concluded that whether an innovation is accepted or not depends on the importance that users attach to the behavioral change and/or the inconvenience arising from the change.

The study revealed that emerging technologies resulted in timeous responses at the point of need. All librarians indicated that new technologies, especially social media tools have made it easier for academic libraries to reach out to users both on and off campus. This corresponded with the view of Radniecki (2013) that libraries can leverage emerging technologies to provide new resources and services that meet the point-of-need location of library users.

All librarians indicated that technologies have afforded librarians opportunities to support e-learning as it plays a huge role in addressing different learning preferences and promoting life-long learning. Similar findings were reported in a study by Nfila (2007) that e-learning assumes a collaborative effort and integration of content, resources and services in support of flexible learning and research.

Social media tools were used to build a closer relationship between librarians and users as it affords quick, cheap and constant communication.

Through digital scholarly communication, researchers are able to connect globally which leads to greater collaboration and sharing of research. Researchers can communicate to a broader research community, thus increasing their research

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impact and visibility. This is made possible by access to the Internet and associated communication tools (Yang & Li, 2016).

Rapid changes in the academic library environment exert greater pressure on librarians, than was the case in the past, to be on the look-out for new trends. Most librarians confirmed to using technologies to keep up-to-date with library trends and new developments in the academic library and higher education environment. They subscribed to alerts, blogs, listserv and Twitter. Some CALICO libraries have employed staff who among their responsibilities, were responsible for scanning for emerging technologies in order to keep themselves and others up-to-date.

New technologies have enhanced the librarians' ability to observe the information gathering behavior of library users and to collect statistics about the use of library resources. Both of these sources of data are important in redefining the role of the library in the digital environment. For example, one librarian observed the use of mobile technology with students taking pictures of catalogue records or book covers when they were looking for books. This observation supports McDonald et al. (2015: 385) statement that "while not all participants are directly involved in data-driven assessments methods, each of them was able to draw astute insights from observations and personal interactions with students that largely fit the students information behavior trends identified in existing literature." Cervone (2010) has suggested that an environmental scan by library staff can determine where there is a need for added value in existing services. Respondents in this study indicated student needs mostly influenced the decision to adopt new technologies or innovative use of technologies.

However, disadvantages were also raised by librarians. Information overload and time consuming issues were of concern to most librarians. Six librarians reported that due to so many technologies being available on the market, keeping up with new developments and/or learning how to use them, took a lot of time. One librarian had doubts about the effectiveness of communicating solely through social networks. A case in point, during student protests in 2015, though one library relied

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on social networks to keep users informed, only 2000 students out of a population of 27000 students were following the library's social networks.

Seven librarians noted that often they had to contend with technical problems. Problems included poor or no connectivity; inadequate of no IT support and poor communication between different library sections.

5.4 How has the use of technology changed the delivery of library user services?

The majority of librarians indicated that emerging technologies enhance the delivery of library user services, communication, access to library resources, training, reference services and research support. Rogers's (1995) DOI theory attributes adoption to the ability of an innovation to improve existing practices. The study established that the use of emerging technologies impacted on ways of delivering library services.

5.4.1 Ease of communication

It is evident that all four libraries made use of social networks, among other resources, to promote library resources and services, to notify their users about events and to make announcements. This concur with Yang & Li (2016) who opinioned that utilizing social networking services enhance and strengthen library communications, public relations social functions, missions and values of libraries in the digital age. An advantage is that most library users are already using some of the social networks on a personal level.

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5.4.2 Access to library resources

Access to library resources has been enhanced through the availability of e-books, open access textbooks and open access journals. Digital technologies have created platforms allowing libraries to offer open access resources. Generally speaking, most academic libraries prefer to buy e-books because they cost less than print copies, allow multiple access, save on shelve space and save on the cost of storage

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(Raynard, 2017). Especially in the last two years emphasis has been placed on rather buying an e-book format of titles if it is available.

One librarians from one institution had alerted strongly to internet connectivity problems. As many academic libraries are currently faced with budget constraints, the provision of open access e-textbooks and e-journals gives them the opportunity to experiment with new less expensive models of delivering services.

5.4.3 Creating online tutorials

The study revealed that librarians use technologies to facilitate online learning environments. Analysis of libraries' websites reveals that there were links to training videos on home pages, to learning management systems and LibGuides. Training of library users has been transformed, for, in addition to traditional face-to-face training sessions, the libraries are offering online tutorials which can be assessed at any time, either from on or off campus, which benefits distance students. This arrangement does away with unnecessarily repeating training sessions and promotes interactive learning. Kleinveldt, Schutte & Stilwell (2016) had predicted that online learning environments would complement traditional face-to-face teaching, by creating spaces for learning that are place beyond the boundaries of the physical classroom.

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5.4.4 Virtual reference services

Findings confirmed that digital presence allows off campus students to request information online and to have a librarian responding to questions and requests. User-centered online or virtual reference services develop knowledge base among online librarians, reach students in their own environment and together with face-to-face reference create the opportunity to reach out to the larger community via the internet anywhere and anytime (Yang & Li, 2016).

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5.4.5 Research support service

Some emerging technologies have enhanced research services, in particular sharing of research findings, to promote collaboration between researchers and to increase and measure research impact. The study confirms that CALICO libraries use Institutional repositories to showcase the institutions' research output and to allow self-archiving of research publications by researchers. The visibility of the institutional research output had thus been increased. Research data management services, an emerging service in academic libraries, had been adopted at CALICO libraries in various stages of developing this service. Libraries store and preserve research data enabling the use thereof for future studies.

The findings of the study revealed that researchers are encouraged to create and maintain an online identity. The online identity is crucial to increase research output visibility, connect with other researchers, create opportunities for collaborations and to evaluate research impact. CALICO libraries' websites are linked to academic social networks, for example, ResearchGate, Academia, Google citations, ORCID.

5.5 Are the technologies adapted compatible to users' needs?

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Compatibility relates to the level at which an innovation can meet the users' needs and to consistency with existing technology. The majority of librarians agreed that most technological innovations were compatible with existing technologies but however, did not meet users' needs to the same degree. Librarians preferred emerging technologies that could be integrated seamlessly with existing tools.

A problem identified by most librarians was the incompatibility of hardware and/or software when they offered information literacy training outside the library building. Kleinveldt and Zulu (2016) experienced a similar problem when web applications needed for information literacy training were not compatible with or available on the tablets used.

Data from interviews with librarians identified ease in meeting the needs of students as the most important criterion for adopting emerging technologies. This finding

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matches that of Islam, Agarwal & Ikeda (2015) who claimed that the major drive for change should focus on the user in order to reflect the changing habits and needs of the digitally connected user.

5.6 Conclusion

Technologies and services discussed in the study do not provide exhaustive coverage of technologies adopted and services transformed by the four academic libraries. However, the focus is on technologies and services mentioned by librarians who responded to the questionnaire or were interviewed, as well as social media applications on the libraries' websites.

Budget constraints, rapid technology developments and new demands from their users are driving the transformation of user services in these four academic libraries. Though some new services have been created, in most cases, these libraries have simply remodeled existing services.

Academic libraries are now using social networks to communicate with their users. Since their users were already familiar with social media, the libraries have followed this trend. It is evident that social networks have afforded academic libraries the opportunity to meet users in their own spaces. Interaction with and feedback from users is fundamental to academic libraries providing services that meet users' needs.

Concerns about academic librarian's attitudes towards technologies emerged more than once in the study. Giving the notion that some librarians are still hesitant to use technologies, either due to resistance to change or lack of proper training, emphasis on provision of training for librarians, support from management, dedicated IT support and allowing time to explore technologies individually or in working groups should be provided.

Some of the respondents expressed concern about the pressure of keeping up-to-date and the challenge of time constraints in the face of rapidly evolving technologies.

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Based on these findings, the researcher comes to the conclusion that rapidly evolving technologies will continue to drive innovations in the delivery of library services.

5.7 Recommendations

- Academic libraries should diversify their marketing efforts to accommodate different university constituents - undergraduate and postgraduates communities.

- Despite the pressure of constantly changing technologies and unrelenting squeeze on university budgets, academic librarians need to adopt technologies that are compatible with both their users' needs and existing technologies.

- In order to stay relevant to users and abreast of library trends, academic librarians must embrace the new technologies.

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Since this study has focused on librarians in the CALICO libraries, future research should be directed at the effects on library users of the innovations in library services.

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Appendices

APPENDIX A – UWC ETHICS CLEARANCE

UNIVERSITY of the
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OFFICE OF THE DEAN
DEPARTMENT OF RESEARCH DEVELOPMENT

4 February 2015

To Whom It May Concern

I hereby certify that the Senate Research Committee of the University of the Western Cape approved the methodology and ethics of the following research project by:
Mrs CT Mafungwa (Library and Information Sciences)

Research Project:	The use of emerging technologies at four university libraries in the Western Cape.
Registration no:	14/3/5

Any amendments, extension or other modifications to the protocol must be submitted to the Ethics Committee for approval.

The Committee must be informed of any serious adverse event and/or termination of the study.

Ms Patricia Josias
Research Ethics Committee Officer
University of the Western Cape

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APPENDIX B – STELLENBOSCH UNIVERSITY ETHICS CLEARANCE

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14 September 2015

Mrs CT Mafungwa
Department of Library and Information Sciences
University of the Western Cape
Cape Town

Dear Mrs Mafungwa

Concerning research project: ***The use of emerging technologies at four university libraries in the Western Cape***

The researcher has institutional permission to proceed with this project as stipulated in the institutional permission application. This permission is granted on the following conditions:

- Participation is voluntary.
- Persons may not be coerced into participation.
- Persons who choose to participate must be informed of the purpose of the research, all the aspects of their participation, the risks to participation, their role in the research and their rights as participants. Participants must consent to participation. The researcher may not proceed until she is confident that all the before mentioned has been established and recorded.
- Persons who choose not to participate may not be penalized as a result of non-participation.
- Participants may withdraw their participation at any time, and without consequence.
- The data must be responsibly and suitably protected.
- The researcher must pay due diligence in seeing that the data is handled in the strictest confidence.
- Data must be collected and processed in a way that ensures the anonymity of all participants.
- The use of the collected data may not be extended beyond the purpose of this study.
- Individuals may not be identified in the report(s) or publication(s) of the results of the study.
- The privacy of individuals must be respected and protected.
- The researcher must conduct her research within the provisions of the Protection of Personal Information Act, 2013.

Best wishes,

Prof Ian Cloete
Senior Director: Institutional Research and Planning

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APPENDIX C –UCT ETHICS CLEARANCE

Humanities Postgraduate and Research Office University of Cape Town
Humanities Faculty Ethics in Research Committee

Room 104, Beattie
Private Bag X3 Rondebosch 7701 Tel:
+27 (0) 21 650 3718
E-mail: Robyn.Udemans@uct.ac.za

Ref. No.: HUMREC201506-09

23rd June 2015

Mrs CT Mafungwa
Library and Information Sciences
University of the Western Cape
Private Bag X17
Bellville
7535

Dear Mrs Mafungwa,

RE: Ethical Clearance for Research Project

I am pleased to inform you that ethical clearance has been granted by an Ethics Review Committee of the Faculty of Humanities for your research project entitled: 'The use of emerging technologies at four university libraries in the Western Cape'. Please take note of the recommendations of the library subcommittee on page two of the report attached.

I wish you all the best with your study.

Yours sincerely,

Associate Professor M Prinsloo
Chair, Humanities Faculty Research Ethics Committee

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APPENDIX D – CPUT ETHICS CLEARANCE

Cape Peninsula University of Technology

P.O. Box 1906 • Bellville 7535 South Africa •Tel: +27 21 4603534 • Email: majamanin@cput.ac.za
Symphony Road Bellville 7535

Office of the Chairperson Research Ethics Committee	Faculty: **BUSINESS**

At a meeting of the Research Ethics Committee on 17 August 2016, Ethics Approval

was granted Thundeza Mafungwa for research activities

Related to the MTech/DTech: Doctor of Philosophy in Project Management at the Cape Peninsula

University of Technology

Title of dissertation/thesis:	THE USE OF EMERGING TECHNOLOGIES AT FOUR UNIVERSITY LIBRARIES IN THE WESTERN CAPE Supervisor: Lizette King

Comments:

Decision: APPROVED

	17 AUGUST 2016
Signed: Chairperson: Research Ethics Committee	Date

Clearance Certificate No | 2016FBREC388

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APPENDIX E – QUESTIONNAIRE

Section 1: Personal Profile

1. **1.1 What is the name of your institution? Choose below** *
   Mark only one oval.
   - ◯ Cape Peninsula University of Technology
   - ◯ Stellenbosch University
   - ◯ University of Cape Town
   - ◯ University of the Western Cape

2. **1.2 Number of years working in this position?**
   Mark only one oval.
   - ◯ 0-5
   - ◯ 6-10
   - ◯ more than 10

3. **1.3 Please indicate your age range**
   Mark only one oval.
   - ◯ 20-29
   - ◯ 30-39
   - ◯ 40-50
   - ◯ more than 50

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4. **1.4 Please indicate your gender.**
Mark only one oval.

- ◯ Male
- ◯ Female

5. **1.5 What is your highest qualification?**
Mark only one oval.

- ◯ PhD
- ◯ MLIS
- ◯ B.Bibl Hons
- ◯ PGDipLIS
- ◯ B.Bibl
- ◯ Other: _____

6. **1.6 Are you currently studying?**
Mark only one oval.

- ◯ YES
- ◯ NO

Section 2: Adoption and use of emerging technologies

7. **2.1 Which of the following technology devices have you used in your line of work in the academic library in the last two years?**
Mark only one oval per row.

	Always	Sometimes	Hardly	Never
eReader	◯	◯	◯	◯
iPad /Tablet	◯	◯	◯	◯
Laptop	◯	◯	◯	◯
Smartphone	◯	◯	◯	◯

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8. **2.2 Any other devices you are using?**

9. **2.3 Which of the following technology applications have you used in your line of work in the academic library in the last two years?**

Please rate your level of competency, on a scale of 1 - 5. 1=Excellent, 2 =Very good, 3=Good, 4=Fair, 5=Never
Mark only one oval per row.

	1	2	3	4	5
Bibliography management tools (e.g. Mendeley)					
Citation analysis (e.g. Google scholar citations)					
eBooks					
Online collaboration tools (e.g. Google docs)					
Open source repository (e.g. DSpace)					
QR Codes					
Recorded tutorials (e.g. Screencasts)					
Social media networks (e.g. Twitter)					
3D printers					

10. **2.4 Any other technology applications you are using?**

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11. **2.5 In which library service(s) have new technologies been integrated? You may indicate more than one.**
Tick all that apply.

- [ ] Circulation
- [ ] Marketing
- [ ] Reference
- [ ] Research
- [ ] Technical services
- [ ] Training
- [ ] Other: _____

12. **2.6 How were these technologies integrated in library services?**

_____

_____

_____

_____

_____

Section 3: Perceptions on adoption and use of emerging technologies

13. **3.1 Please explain advantages experienced after adopting emerging technologies?**

_____

_____

_____

_____

_____

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14. **3.2 Were there disadvantages experienced after adopting emerging technologies?**

15. **3.3 Please explain how compatible adopted emerging technologies were to existing library services?**

16. **3.4 In your line of work, did you experiment with emerging technologies before implementing?**
Mark only one oval.

- Yes
- No

17. **3.4.1 If YES, how did you trial it?**

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18. **3.4.2 If NO, why not?**

19. **3.5 Please explain difficulties experienced when implementing or managing emerging technologies in your library?**

20. **3.6 "emerging technologies are easy to use"**
What are your views on this statement

21. **3.7 Were you able to observe the effective use of emerging technologies in the library by users?**
Mark only one oval.

- ◯ Yes
- ◯ No

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22. **3.7.1 If YES, what were you able to observe?**

23. **3.7.2 If NO, why were you not able?**

23. **3.7.2 If NO, why were you not able?**

23. **3.7.2 If NO, why were you not able?**

23. **3.7.2 If NO, why were you not able?**

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26. **3.10 Please add any other general comment you have on emerging technologies.**

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APPENDIX F - INFORMATION SHEET

6 November 2015

Dear Colleague

I would like to request you to take part in this research study and answer the questionnaire attached. I am busy with a Master degree in Library & Information Studies at the University of the Western Cape. I am required to do research and produce a mini-thesis. The topic of my research project is "The use of emerging technologies in four academic libraries in the Western Cape."

Questions asked cover the use of emerging technologies in your library and will explore your perceptions as a librarian of emerging technologies.

The completed questionnaire should be returned to me by submitting the Google form.

If you have questions on the study you can contact Thundeza Mafungwa at thundeza@yahoo.com, or my supervisor Doctor Lizette King at lizetking@gmail.com.

Your participation in this regard is greatly appreciated.

Yours Sincerely

Thundeza Mafungwa

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APPENDIX G – CONSENT FOR QUESTIONNAIRE

If you agree to voluntarily take part in the above research, please, tick below:

- I confirm that I have read and understood the information in the sheet and agree to take part in this research.
- I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.
- I understand my participation is voluntary and I am free to withdraw at any time without giving any reason and that I do not have to answer every question.

Signature……Date:/…../……/2015.

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APPENDIX H – INTERVIEW GUIDE

1. For how long have you worked as a subject/faculty librarian?
2. Are you currently studying?
3. If yes, which course are you studying?
4. Which technology devices have you used in your line of work?
5. What emerging technologies have you adopted in your line of work?
6. Please describe how you integrated emerging technologies in library services?
7. What factors influenced your decision to adopt emerging technologies?
8. What impact has the use of emerging technologies had on the delivery of library services?
9. How do you keep up-to-date with new library trends?
10. General comments?

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APPENDIX I – CONSENT FOR INTERVIEW

Private Bag X17, Bellville, 7535
South Africa
Secretary: Sonia Stroud
Tel: +27 (0) 21 959 2137
Fax: +27 (0) 21 959 3659

FACULTY OF ARTS

Department of Library & Information Science

Dear Participant,

Letter of Introduction and Informed Consent Form

I would like to request you to take part in this research study conducted to produce a mini-thesis for a Master in Library & Information Science at the University of the Western Cape. The topic of my research project is "Use of emerging technologies at four academic libraries in the Western Cape by faculty or subject librarians."

Questions asked cover the use of emerging technologies in your library and will explore your perceptions about emerging technologies as a librarian. You have been invited to participate as Faculty or subject librarian working in a university library represented by Calico using contact details provided on your library's website. The study focuses on the four Calico libraries in the Western Cape. It should take approximately 30 minutes. Interviews will be conducted by the researcher, audio-taped and later transcribed for the purpose of data analysis.

There will be no identifying of participants on interview transcripts. Codes will be used for identification of participants when transcribing. Responses for this study will remain confidential and anonymous. Pseudonyms will be used for participants and institutions in the publication of thesis. Responses will be kept in an online environment protected by password. Responses given for this research project will be used for the mini-thesis.

There are no risks or discomforts anticipated from your participation in the study.

Knowledge obtained from the study will be of great value in learning how emerging technologies have been integrated in the delivery of services, insights of technology trends in university libraries and discover creative use of technology to reach out to users.

If you have questions on the study you can contact Thundeza Mafungwa at Thundeza.Mafungwa@cput.ac.za or my supervisor Dr Lizette King at lizetking@gmail.com

I, _____ (name; please print clearly), have read the above information. I freely agree to participate in this study. I understand that I am free to refuse to answer any question and to withdraw from the study at any time. I understand that my responses will be kept anonymous.

_____ _____

Participant Signature Date

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