NELSON MANDELA UNIVERSITY

TECHNOLOGY ACCEPTANCE MODEL PERCEPTIONS OF OPERATIONAL STAFF ON THE IMPLEMENTATION OF ADVANCED RADIOGRAPHY EQUIPMENT

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A treatise submitted in partial fulfilment for the degree of

MASTERS IN BUSINESS ADMINISTRATION

in the faculty of Business and Economic Science

at the Nelson Mandela University

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April 2023

DECLARATION

I Bryan Gerard Anthony James 223535109, hereby declare that the treatise/ dissertation/ thesis for the qualification of Masters of Business Administration to be awarded is my own work and that it has not previously been submitted for assessment or completion of any postgraduate qualification to another University or for another qualification

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ACKNOWLEDGEMENTS

I would like to express my appreciation to my mother, Patricia May James; my brother Connor Levi James; his ever-loving wife Angie and their fun loving and adorable children Caleb, Georgia Chloe. A very big thank you goes to my special lady Liza Malagoli for all the support, snacks and much needed distractions throughout my academic journey. To all of my friends near and far away who have given me the time to focus on my studies and share short but great times when we could. Lastly, I would like to thank each and every member of the Nelson Mandela University Faculty of Business and Economic Science for providing me and many others the opportunity to grow and develop and for keeping their word and providing the students with their time, resources and insights which have made all the difference in a very interesting and challenging moment in many of our lives.

LIST OF ABBREVIATIONS

A	Attitude Towards Use
ALARA	As Low As Reasonably Possible
BI	Behavioural Intention
BPM	Business Process Management
CR	Computerized Radiography
DICOM	Digital Imagery and Communications in Medicine
DTPB	Decomposed Theory of Planned Behavior
EHR	Electronic Health Records
HIS	Hospital information Systems
ICT	Internet Communication Technology
IT	Information Technology
IDT	Innovation Diffusion Theory
PACS	Picture Archive and Communications System
PEOU	Perceived Ease Of Use
POPIA	Protection Of Personal Information Act
PU	Perceived Usefulness
SN	Subjective Norm
TAM	Technology Acceptance Model
TAM2	Technology Acceptance model 2

TPB	Theory of Planned Behavior
TRA	Theory of Reasoned Action
UTAUT	Unified Theory of Acceptance And Use of Technology

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ABSTRACT

Throughout the recent history of South Africa, the increasing requirements from state and private sector healthcare institutions have relied heavily upon medical imaging technologies for the purposes of improved patient healthcare and service quality standards. Developments in this field of healthcare have seen many interesting and challenging operational changes: from the first implementation and use of X-ray equipment demonstrated in Krugersdorp in 1899; to the current advanced digital systems found in the medical imaging services sector of healthcare.

This research study measured the medical imaging operational staff perceptions about new advanced medical imaging equipment and technologies. The theory crossed the academic disciplines through a quantitative survey about technology, operations management and healthcare. Together with staff perceptions about future medical imaging technologies' usefulness and ease of use, the findings may impact their daily operations within a conducive technology acceptance management paradigm.

Contents

CHAPTER 1

1.1 INTRODUCTION

The world of advanced technology has changed significant during the 21st Century, especially within the realm of medical science and its application. This current study is in radiography, especially regarding the acceptance or rejection by radiographers of the introduction of new advanced medical imaging technologies. The focus is on the adoption and implementation of new technology as applied to medical imaging that is used by radiographers. The context of the research is within the independent radiographic private sector in the Republic of South Africa.

Historically, medical imaging service providers have been met with challenging operational requirements, as the population of South Africa increased, so too has the need for medical imaging within the healthcare environment. Meeting the demands of such services required the industry to improve on quality, operations and reduce the wastes involved with medical imaging whilst improving on service performance. Making operational improvements aimed at reducing undesired excess radiation exposures to the patients and operational staff involved.

The medical imaging industry remains in a constant state of motion, medical imaging still provides clinicians and healthcare workers accurate medical information for improved decision making and optimized patient treatment processes needed for the betterment of the society. Improvement processes within the medical imaging environment has required the desired level of operator participation and acceptance of such technological changes to deliver improved operational environment. The capacity of such operations has to be capable of meeting the increasing demands for services and to further generate reductions of operational wastes incurred whilst being mindful and striving towards the improvement of operational and patient safety measures which are a necessity when operating equipment and technologies which produce levels of radiation.

1.2 THE PROBLEM STATEMENT

Medical science literature has indicated that the introduction of new advanced medical technology has often lead to employee resistance of such technology (Ileri & Arik, 2018). This resistance often related to how management implemented and managed the introduction of new technology. (Strohm, Hehakava, Ranschaert, Boon and Moors 2020).

This study is motivated by the fact that there is a paucity of research within the radiography context regarding technology adoption and implementation.

The study therefore investigates new medical technologies and the acceptance thereof within the medical imaging environment and the resistance of adoption of such technologies of clinical staff members, namely radiographers. The research seeks to assist health care management identify various factors that may influence the implementation of new technologies within their businesses.

1.4 THE RESEARCH QUESTION

What are the perceptions of operational staff that influence the adoption and implementation of advanced radiography equipment and technology, as identified by radiographers within a medical imaging business environment?

1.5 RESEARCH OBJECTIVES

1.5.1 Primary Research Objective

To explore the perception of radiographers regarding the implementation of new advanced technology within the medical imaging business.

1.5.2 Secondary Research Objectives

Related to the primary aim the study aims to achieve the following objectives:

1. To survey operational staff members within a medical imaging environment regarding their perception of new advanced medical imaging technologies.
2. To survey operational staff members within a medical imaging environment on what they think of advanced medical imaging technology.
3. To ascertain whether operational staff believe that advanced imaging technology will enhance their operational efficiency.
4. To determine whether operational staff reject or accept advanced imaging technology

These objectives are closely aligned to a study conducted by Sabur Safi, Thomas Thiessen and Kurt Schmaizl, (2018) in which the study provides insight regarding the acceptance of new technologies in the healthcare context and the various factors of resistance of such new technologies from the healthcare operations staff compliment.

1.6 METHODOLOGY OF THE STUDY

The study will be located within a quantitative positivistic paradigm. The quantitative data will be summarized and statistically analyzed. The research instrument is an electronic questionnaire consisting of relevant TAM closed ended questions and Likert-type scale.

1.6.1 Introduction

A literature review and an empirical study were used to solve the main and secondary objectives. The literature review assisted with identifying emerging themes of the

various factors which radiographers accept or reject new advanced technologies within the medical imaging industry. Regarding the empirical study, a questionnaire was developed by the researcher to gain insight on the leading factors of technology acceptance or rejection within the medical imaging environment specifically aimed at the perceptions of radiographers.

1.6.2 The sample

As of 2022, there are a growing number of private sector radiology departments in South Africa. To focus the study one such entity will be selected. The entity selected can therefore be seen as representing purposeful convenience sampling as. Such sampling is understood to be purposive sampling, a sampling technique in which researcher relies on his or her own judgment when choosing members of population to participate as indicated in the works of Gomer, Hasyim, and Kusumapradja (2020). The sampling process and sample type is therefore non-random. The researcher is conscious of the limitations of such an approach.

For anonymity the entity will be referred to as Rad X. To gain access to the entity the entity requested that anonymity and confidentiality of identification of the entity be assured. The population consists of approximately 322 people, this includes radiologists, radiographers, and other staff. They are dispersed over a region of approximately 200-kilometer radius in multiple office locations. The focus of the study is on direct user (radiographers currently in operational field, using the imaging equipment) and Indirect user (Radiologists currently active in the reporting and diagnosis activities within the department.) These are the influencers and decision makers who make the decisions of purchases of equipment.

1.6.3 Research limitations

Due to the sample size, the study is limited in the extent that generalizations can be made to all South African private sector radiology departments. Such generalization is

compounded by the limited amount of research on such departments, specifically in a developing country context. Nevertheless, to draw conclusions from the data obtained.

1.7 SAMPLING DESIGN

Sampling design is understood as the identification and collection of individuals which are to be surveyed. As the empirical component of this study will be limited to the operational users of medical imaging technologies within the Eastern Cape who currently work in the private sector medical imaging services industry.

1.7.1 Research Population and Sample

The sample targeted approximately 50 to 70 operational staff. This excludes radiologists and other staff in the clinical radiography/medical imaging environment such as non-academic radiographers.

1.8 MEASUREMENT INSTRUMENT

A questionnaire consisting of open and closed ended questions and Likert style questions was formulated. The questions tested the perceptions of radiographers and their acceptance or rejection of new advanced medical imaging technology. The questions were developed by examining the hypotheses, primary and secondary objectives, and the problem statement.

The distribution frequency method was applied in order to group various questions which have been answered. This method will reflect the manner in which the scores on a variable list are distributed and how the frequencies of the measurement categories vary.

1.8.1 Data Collection techniques

Data were collected using an electronic questionnaire. The researcher was of the opinion that this is the most appropriate method to use as the research participants are spread over a wide geographical area, are well educated, and have limited time to complete the instrument. Furthermore, an electronic questionnaire in terms of the literature is seen as beneficial for the following reasons:

1. Management also supports the use of an electronic questionnaire as it is seen as the least disruptive to their business. The researcher is aware that electronic questionnaires have the following limitations such as survey fraud and absence of interviewer which may be required when requesting open ended questions. Furthermore, an online survey may fail to reach the desired population. However, the advantages outweigh their usefulness in the current research as it is seen as meeting the needs of the study and is resource effective.
2. The questionnaire and required documentation were forwarded to the manager. The manager distributed it to the respondents. This process is the only way to comply with the Protection of Personal Information Act (POPIA) (Republic of South Africa, 2013) (No 4 of 2013). Due to the stringent requirements of the Act, the researcher will not have direct access to the participants. The researcher is aware of the manager's role as a gatekeeper may have an impact on data collection; however, it complies with the company's preferred way of centralising data collection and minimising employee disruption. Participants were able to submit the completed questionnaire directly to the researcher. Every two weeks a reminder email was sent to all participants via the manager. This process continued until an appropriate number of responses have been received.

3. Linking to TAM and derived from the TAM model, the electronic questionnaire will be divided into themes,

    1. Within the response of a user, perception of such new technology is to measure Perceived Ease Of Use (PEOU), and Perceived Usefulness (PU).

2. Within the user's response, operational benefits will be measured by the Attitude towards use/using (A).

3. Finally, the user's behavioural response will be measured by Behavioural intention to use (BI) which reflects the users physical and behavioural response.

These themes and related questions will be aligned to the research problem, research objective and research aims.

1.8.2 Data analysis and interpretation

The collected information from both the surveys and the literature will be analysed in order to determine the conclusion and significance of the study and the implications thereof.

The literature will provide insight regarding technology acceptance of new advanced medical imaging technology within the context of the healthcare and medical imaging industry. The data collected from the survey will provide insight of what the perceptions of radiographers currently working in the Eastern Cape private sector medical imaging arena perceive of new advanced medical imaging technology and the benefits or hesitancies thereof.

1.8.3 Ethical considerations

All efforts to ensure informed consent, confidentiality, integrity, and anonymity will be adhered to in accordance with the stipulations of the University ethical requirements and the Protection of Personal Information (POPI) Act No 4 of 2013.

1.8.4 Informed Consent and anonymity.

Written consent was sought and obtained from the gatekeeper. Furthermore, it was explained that participants are free to withdraw from the process or exclude themselves completely. Anonymity is guaranteed as no form of identification, questions of age, race, gender, religion, or political preference were used in the questionnaire.

1.9. SUMMARY

Advanced technologies may offer medical imaging services an opportunity to improve on current operational standards and produce new avenues in which medical imaging is able to decrease wastes, increase service performance and drive operational standards in line with policy guidelines to holistically improve on the quality of imaging and healthcare service. This study will thereby contribute towards the existing body of knowledge by Safi, Thiessen and Schmailzl, (2018) and others, by highlighting the post-pandemic context for advanced medical imaging theory and operational practices . The research seeks to further assist healthcare management, notably medical imaging institutions and radiologists to identify factors that may influence the implementation of advanced technologies within the environment. By doing so, healthcare providers may improve on current operational standards of patient care by using less resources such as time and capital which are wasted with failed equipment and technological application installations.

CHAPTER 2 LITERATURE REVIEW

2.1 Introduction

In the previous chapter, the researcher considers the problem statement in which it is understood that the implementation of new technologies in the healthcare environment are often met with employee and user resistance of such new technology. Such resistance related to the manner in how management had implemented and managed the implementation process of the technology. Gaining an understanding of the perceptions of the operational staff regarding the various factors which influence the adoption, implementation and management of advanced radiography technologies is the focal point of this body of research.

Throughout chapter two, the researcher elaborates on the various intricate aspects of technology acceptance, how new technology contribute towards various improvements and optimisations in the operational environment and enhance the quality of operational services. Furthermore, various theories surrounding technology acceptance and operational improvement are discussed below.

The Technology Acceptance Model (TAM) is often used to help explain the user behavior in an information system or context of new technology method of adoption. A significant volume of academic research exists where the model has been tested and proved itself to be accurate.

Alagu, Sundaram, and Natarajan, (2015) further elaborate on the factors within TAM with the intention to scrutinize the model and the differences related to the various specifics within the volume of research. Furthermore, they attempted to review the applications in which TAM may be implemented and eluded to the potential that future research may make attempts at providing further extensions and adaptations of the model. Future research on the TAM could benefit researchers to better understand the users' engagement and acceptance of technology.

Researching the usage of new technologies and the acceptance thereof may be considered to provide great significance within the domain of software engineering. In

order to better contextualise a technology user's behaviour towards such new technologies, various models and theories have been offered throughout recent history. These present themselves each with their own set of unique strengths and weaknesses. In various cases, these theories are considered to be almost identical in theoretical structure however do offer different explanations regarding behavioural intentions of new technology acceptance.

2.2 PRIOR RESEARCH

The literature review consists of a number of referenced journal articles, which assist to establish the understanding and insight regarding the medical imaging business environment within the South African context. Through the information obtained, the research established how such new technologies within the medical imaging industry have positively affected the operational process and service capabilities. The implementation and management of new advanced imaging technology are considered to be a key factor within the research for the purposes of adding to the existing body of research. Further, to provide management insight with regards to improving the quality of healthcare management.

2.2.1 Conceptual overview and the developmental history of different imaging technologies

Studies by Bercovich and Javitt (2018) reflect how the advancements in the medical imaging industry have offered benefit to society and improved functionality due to quality improvements, time reductions of image acquisition and operational procedure improvements within the x-ray environment. Such forms of new technology have made noticeable contributions towards reducing the environmental impact that the previous conventional methods were unable to provide.

Evolving medical imaging x-ray technology has produced significant operational and societal benefit. Born from the early developments starting from the Netherlands in 1896 by the Nobel prize winner Wilhelm Conrad Rontgen to the onset of medical diagnostic radiographic image acquisition, improvements, and acceptance of various adaptations within this field yielded much success regarding improvements to the healthcare environment. Over time, the increasing perceived benefit of such new technological adaptions to medical imaging, the demand for x-ray services expanded. Such expansion offered both positive and negative consequences to the clinical environment, the staff involved and the quality of patient care. (Eastgate, Neep, Steffens and Westerlink, 2020). Chemical processing of x-ray images generated further environmental effects as the waste chemistry needed to be correctly disposed of as various components of the chemistry did include toxic chemicals and heavy metals which had the potential to create significant damage to the greater environment. (Emmanuel, Pieper, Rushbrook, Stringer, Townsend, Wilburn and Zghondi, 2014)

By 1973 the ALARA (As Low As Reasonably Achievable) principal was introduced. This principal made considerations regarding the radiation dose levels. Zainuddin (2017) reflects on how the ALARA principals require radiation workers to mitigate any radiation exposure that is not of medical benefit and all uses of radiation exposure are to be effective in the scope of generating an efficient medical image of the desired level of diagnostic quality.

With such benefits in technical advancements, Schaetzing (2003) elaborated on how companies in the x-ray market pursued offering Computerised Radiography (CR) systems. Healthcare providers had moved from the conventional film process and utilized CR systems which provided faster image acquisition times, improved image quality and further eliminating the need for chemical processing. Image storage moved from the format of original x-ray document to that of a Digital Imaging and Communications in Medicine (DICOM) image file which was stored on computer systems which over time, was adapted into the Picture Archive and Communications Solution (PACS). Such devices made any version of analogue storage redundant as it

offered superior image processing and high-fidelity images in a digitized format. (Modrák and Modrák, 2013).

The significant growth of medical imaging in South Africa offered substantial benefits to the community and continues to do so with the improvements of quality of diagnostic information and patient care. The department of health Directorate of Radiation Control stipulates the various acts, regulation's, guidelines, and code of practice regarding the safe and proper use of radiation within the field of the healthcare environment to control and monitor the sector effectively and improve the standards of healthcare practice. These implementations have proven to be effective in the monitoring and controlling of radiation and have made improvements in environmental safety. (Department of Health Directorate: Radiation Control, 2012).

Advancements in x-ray technology has brought about significant changes, the healthcare environment. Developments starting from 1896 after the discovery of X-rays by the Nobel prize winner Wilhelm Conrad Rontgen to the medically capable radiographic image acquisition through the German based Siemens and Halske Johannesburg branch, which demonstrated the first unit in Krugersdorp shortly after the Anglo Boer War in 1899 (de Villiers, 2013). As the X-ray industry expanded, so too was the demand of various inputs required to successfully operate the machinery, technology required to generate improved healthcare quality. Chemicals such as fixer and developer where required for medical imaging, unfortunately for many radiographers, such exposure to the chemistry had various health consequences which ranged from respiratory ailments to skin damage. (Sarafis and Chalaris, 2015).

Processing speed and image acquisition of such wet film-based methods took longer than what CR image acquisition models offered. However, the need for such technology offered significant benefit to the quality of diagnostic information and patient care. It was expected that the positive benefits of such procedures outweighed the negative impact thereof. Bercovich et al. (2018) described the progress toward best practice methods implemented over time, which made considerations for the image quality, use of X-ray

devices, processing methods, patient safety and environmental health. By 1973 the ALARA (As Low As Reasonably Achievable) principal was introduced, this principal made considerations regarding the radiation dose levels and the benefit of such levels being required. Zainuddin (2017) reflected on how the ALARA principals require radiation workers to mitigate radiation exposure that is not of medical benefit. As wet film image processing continued, many of the operational challenges still hampered the industry. Such challenges were the issue of storing and archiving medical images, silver recovery, safe disposal of chemical wastes, Operator health effects of chemical processing and environmental concerns. As the need to X-ray imaging inclined, so too did the by-product of the imaging process indicated by Chow, Brauer, Chessor, and Kennedy (2002).

Fujifilm Medical Systems introduced the first CR system in the 1980's. Initially aimed at the veterinary market due to international regulatory framework and medical device registration processes. The company had received great interest and praise for pioneering in the field. Pitcher, Van As, Sanders, Douglas, Wieselthaler, Vlok, Paverd, Kilborn, Rode, Potgieter and Beningfield, (2008) show how this cultivated interest from the medical fraternity as new technology offered users faster image processing. Furthermore, image quality was improved. With such benefits in technical advancements, Schaetzing (2003) shows how vendors pursued offering CR systems into the market. Healthcare providers were then able to move away from the conventional film and utilized CR systems which provided imaging services improved image acquisition turnaround times, image quality and eliminating chemical processing. With advancements in X-ray services one can observe the benefit of improved technological performances. As such, the need for the service and the urgency of such quality in diagnostic imaging along with a growing population proved to be a fundamental reason as to why more X-ray systems were needed in the field by hospitals and clinics. (Winder, Owczarek, Chudek, Plich-Kowalzyk and Barron, 2021).

2.2.2 Operational benefits of changes

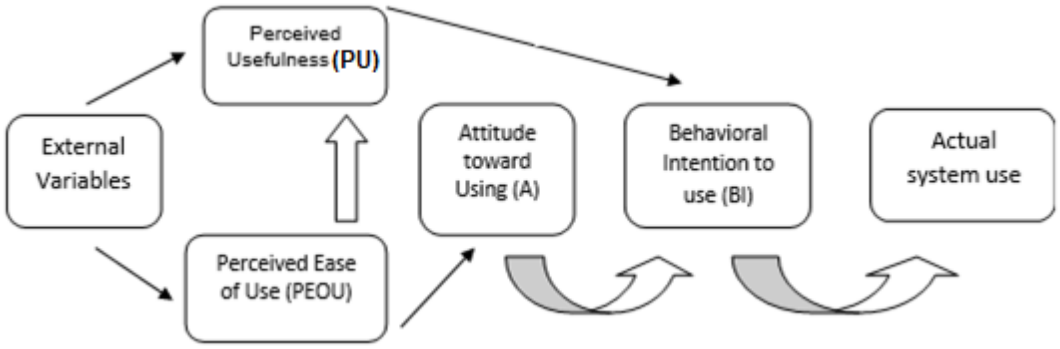
The literature has established the noticeable need for good practice standards and optimised patient care. The identifiable line between the impact of X-ray technology had on the environment and the derived societal benefit. From the history of both regulations imposed and from advancements in X-ray technology which produced a leaner and more effective operational standard. (Zainuddin, 2017). With all considerations made throughout the history of such technology, the benefit of patient healthcare is of top priority. (Nilsen, Seing, Erricsson, Birken and Schildmeijer, 2020).

Throughout the history of the medical imaging, it can be observed that new technologies produced operational advantages and improvements to benefit healthcare quality and a competitive advantage perspective. Also, from the viewpoint of acceptance of the operational staff involved. Such technology provided the desired perceived and operational benefit which generated the desire for healthcare workers to adopt the new technology and switch over from the standard to the new technology available.

2.2.3 Advanced imaging technology

The technology Acceptance model (TAM) has its roots in the theory of reasoned action and is largely used to extrapolate a person's behaviour towards acceptance of new technologies. TAM was originally put forward in 1989 by Mr. Fred Davis for his doctorate proposal which was an adaptation from the Theory of Reasonable action. TAM is used to address the end user's acceptance of technologies.

Figure 1: The Technology Acceptance Model



The technology Acceptance model adapted from Davis 1989 (Researchers own construct)

In figure one above, it is shown that certain variables can influence user perceptions, attitudes, and behavioural intentions as it pertains to the acceptance of new technologies. The TAM has been applied in a variety of industries over time, but this study discourse below focuses on the health industry.

2.2.4 Technology acceptance model in healthcare

Laurenza, Schiavone, and Vrontis (2018) clarify that there is evidence reflecting that healthcare service providers which adopted digital technologies have improved on their respective operational processes and produced an improved healthcare service. Addressing the infrastructure requirements to meet such technological adoptions has been and remains critical for future healthcare technology management from an internal operational framework perspective, and for cross cooperation involving other healthcare service providers to produce efficiencies in access to diagnostic information to better patient service quality and outcomes.

Alqudah, Al-Emran, and Shaalan (2021) via literature review indicate that when considering such technical implementations into the clinical environment, management needs to ensure that there is the required level of support and infrastructure to drive

such implementations especially in rural areas. Decision makers and Information Technology (IT) managers are required to collaborate to ensure infrastructure and resources are available before engaging healthcare clinicians and staff. Perceived ease of use (PEOU) may be seen as a derivative of infrastructure capacity as suggested in the research provided by Helia, Asri, Kusrini and Miranda, (2018). End users of advanced technologies are required to be informed and trained comprehensively on their roles to enhance user acceptance. Gaps in technological advancements need to be identified at an early stage and remedied to provide end users with the level of surety needed.- (K. Naidoo and Naidoo, 2018).

Gomer, Hasyim, and Kusumapradja (2020) via hypothesis testing prove that attitude toward using affected the intention to use positively. Indicating that clinical staff reflect the need for system performance regarding hospital information systems (HIS). Indicating that the higher the perceived and actual benefit of using new technologies, the more likely the behavioural intention to adopt the system. Such positive performance indicators provided by new technologies within the environment are attributable to end users adoption in that the technology provides improvements within the operational framework and reduces operational wastes.

Woznitza, International Society of Radiographers, and The European Federation of Radiographer Societies (2020) emphasise that operational staff in the medical imaging services need to participate in the planning, implementation, and usage of diagnostic software. Medical imaging software is an essential technology which has the ability to assist imaging departments given that the application is correctly administered. The desired improvements of medical imaging performance rely on the active participation and education of radiographers and the applied related radiographic technologies.

Gerigoorian and Kloub (2021) conclude in a cross-sectional study that the introduction of new technologies into healthcare services depended on the benefit the end user perceived such technologies to hold. The importance of obtaining insight regarding the factors which influence the acceptance or rejection of new technologies may therefore

be advocated. advanced technologies in medical imaging offers improvements regarding reductions in operational wastes and improved work performance. By the application of the TAM3 model, the research reflects that the behavioural intention to adopt advanced technologies among medical imaging professionals is strongly influenced by the level of perceived usefulness (PU) and lesser influenced by perceived ease of use (PEOU).

2.2.5 Implementation process of advanced imaging technology

International Atomic Energy Agency (2015) Position this publication at the various administrative, technical, and clinical staff within the medical imaging environment. The document provides introductory framework for the successful implementation and management of digital technology and the required infrastructure involved whilst conceptualising an understanding of various issues which need to be considered when implementing new imaging technologies. The publication assists administrators, management radiologists, radiographers and further includes clinical engineers and information technology staff ensuring better congruency and collaborative benefit within the operational framework.

Abbas and Singh (2019) reflect that inadequate knowledge of information technology was a challenge that impaired successful implementation. Inadequate computer literacy proved to be a major challenge to vendors when implementing PACS. Resistance to change was reported with PACS users deficient in IT experience. Furthermore, a deficiency in leadership and management strategies offered further challenges during implementation and training phase. New medical imaging technologies accompanied with IT infrastructure and inter connectivity which enables the transmission medical imaging between departments and end users has proven to be a challenge for technology vendors due to end user hesitations.

Understanding the implementation of advanced imaging technologies is a challenge when implementing new technologies in developing countries as there may be a

multitude of issues that may take president and hinder the success of such implementation. (Baccei, Henderson, Lo and Reynolds, 2020). Such challenges within the medical imaging environment namely inadequate infrastructure, capacity, vendor concerns and the required operational space within this context are considered to be focus areas for technology vendors within this arena. (Abbas and Singh, 2019).

2.2.6 Employee reaction to the implementation of advanced imaging technology

Chen, Stavropoulou, Narasinkan, Baker and Scarbrough, (2021) discusses the increasing knowledge of new innovations within the medical imaging field reflect that radiologists hold wider knowledge of the applications of new technology over that of the radiographers. The new technologies exhibited by medical imaging technology vendors is evolving rapidly to enhance performance. The results infer professional responses to new medical imaging technologies are correlated to specific work roles and are further mediated by the differences of the knowledge and attitude's attributed to the interpersonal difference.

Through the research provided by Gomer et al. (2020), end users intend to use advanced medical equipment technologies due to improvements in productivity and performance. A requirement for the adoption and use of advanced technologies is effective training, participation and socialisation between end users and the technology vendor to assist the end users and ensure that such implementations prove to shorten the adoption time. To increase the likelihood of a positive response by end users and increase the performance of new technologies, it is understood that the new systems implemented are required to be user friendly and prove to reduce operational wastes.

2.2.7 Management and new advanced imaging technology

The technology acceptance model (TAM) establishes a measurement of the adoption of new technologies based on the attitudes of end users. The application of TAM assists

change managers to navigate and successfully implement new technologies for the betterment of operational and business process.

Nadri, Rahimi, Afshar, Samadbeik and Garavand (2018) discuss how information and communication systems in the healthcare environment focus on improvements of patient care. TAM and other technology acceptance models played a role in the end users' behavioural intention to utilise HIS. The end users' behavioural factors prove to be essential for the successful implementation and usage of new technologies. User perception, knowledge, and attitudes towards changes in the environment pose challenges. Implementation of new technologies rely on the end user's ability to understand the benefits derived, to feel competent of their knowledge of new technology and for the required resources to be available to ensure implementation support. Based on the preliminary research reviewed, the research question is formulated as follows below.

2.3 Noticeable improvements in efficiency

Alqudah et al., (2021) aimed the study in a position to provide insight on the various studies published regarding technology acceptance in the healthcare arena. They provided a detailed classification and analysis which included the various technology acceptance models and influential factors and for the types of various studied information technologies. By reviewing 1768 published studies of which 142 studies were considered valid, the findings suggest that there is clear evidence that TAM and the Unified Theory of Acceptance And Use of Technology (UTAUT) are the two most prevalent technology acceptance models. Both TAM AND UTAUT have been shown to be the most utilised factors to comprehend the acceptance of new technologies within the healthcare domain. With considerations made to various other factors which were extensively studied throughout the literature it becomes clear that there is still space available for the integration of the various technology acceptance models or alternatively to enhance new factors to the current models in order to produce more valid acceptance models in the future.

Although UTAUT an TAM both offer strong advantages and bare sufficient benefits regarding how end users accept and and/ or reject technology, this study will focus on purely on TAM. The reason for this is due to the established research which reflects that TAM bares its application of research to the individual user as opposed to UTAUT which focuses on the organisational level.(Olumide, 2016) This study focuses on the personal perceptions of users of new advanced medical imaging technology and how such new technology may be accepted or rejected by end users from their respective perceptions and not from the viewpoint of an organisation in which UTAUT would be applicable.

Further indicated by Durodolu, (2016) the TAM is a significantly popular construct that assists in the understanding the relationship between people and technology.

Davis, (1989) the creator of the Technology Acceptance model (TAM) provided two variables namely Perceived usefulness (PU) and Perceived Ease of Use (PEOU) which play influential roles regarding the perceptions which ultimately determine whether a user may adopt or reject technology. These two variables further provide insight in determining a user's intention in the development of new skill sets. Davis further conducted experiments in order to validate TAM by using both PEOU and PU as the two independent variables with the dependant variable, System usage. The findings of the research experiments reflect PU was significantly correlated with current use and future usage. Furthermore, PEOU was also found to have a significant correlation with current and future use. PU held a significantly greater correlation with system usage than that of PEOU. Regression analysis of the statistical findings of the experiments performed reflect that PEOU may be a precursor of PU as opposed to the perspective of PEOU being a direct determinant of usage implying that PEOU affects the acceptance of technology indirectly through PU.

2.4 Improvements on operational methods

Pereira, Vergara, Merino and Wagner (2015) consider the management practices required to make the desired improvements within a radiology department by using lean methods and process standardisation coupled with improvement process and order flow. Various implementations within the sector assists to increase safety and functionality, improve workflow, and minimise human error. Improvement tools within this service-based context include benchmarking to best analyse and compare the level of service with the competition. Addressed in the literature is the need for management processes to aid in the method required to be adopted when and where changes are required. This is the case in the introduction of new technologies which offer the desired level of process improvement, waste reduction and competitive advantage.

Pereira et al., (2015) further elaborate that such medical imaging services are in operation and continue to exist for the benefit of the client and for this reason, emphasis is focused upon user satisfaction. When attempting to seek opportunities to improve on the current standard, management may need to contextualise the various problem which arise and further to address the root causes in such instances. The article specifically addresses the need for implementation of continuous education in the medical imaging service industries and further, in-depth understanding of the management practises within medical imaging to address and assist future research regarding implementation processes of new technologies. These concerns may become more pertinent going forward with regards to implementation and management of the required changes since this will aid in the betterment and development of this service-based organisations.

The current research study explored the identified variables above, of such operational improvements from the perspective of the medical imaging services operational staff. Gaining insights as to how such factors influence the adoption or rejection of new technologies which may play a vital role in the healthcare services industry for future generations. Furthermore, to assist various levels of management may derive operational insights from such perspectives.

2.5 Improved quality of healthcare

Ganguly,Chakraborty, Balitanas and Kim, (2010) discuss the advancements of medical imaging over the recent history and point out that such advancements have positively contributed to improvements in early detection, diagnosis and therapeutic procedures. These operational practices are made possible due to the advancements in the adoption of new medical imaging technologies. Once again, it is seen that such ongoing development may require continued research within the applied sciences (such as physics, mathematical sciences and software development science) as these fields have significantly contributed towards the field of medical imaging.

It is further postulated that such advancements within the medical imaging and specifically biomedical imaging technologies hold the potential to assist medical and societal issues ranging from mental disorders, neurological and metabolic disorders. This article stipulated that the need for unified and continuous education throughout the medical imaging industry is essential (Ganguly et al., 2010).

Roy, Colpitts, Becker, Brewer and van Lutterveld, (2018) discuss how lean operations management, which had originated in manufacturing, has been adapted and applied to various industries including healthcare. The principles of lean management have been seen to be successful when addressing time periods and length of hospital stays for patients. The studies referenced in this article provided information that the application of lean strategies assisted in the reduction of post-surgery length of stay in various orthopaedic procedures. Evaluating lean manufacturing principles, which have been applied to inpatient pharmacy drug dispensing, the results reflected a time savings in excess of 40% which was mentioned as a reduction in the cycle time. Furthermore, another study evaluated the implementation of lean six Sigma in combination in order to reduce the turnaround times for emergency department specimens. The results reflected significant multiple improvements which included turnaround times and the reduction in unused specimens, thus resulting in a positive impact on team empowerment. Altogether these improvements further produced considerations for continuous improvements within the work environment. Practical and operational

improvements allude to the fact that continuous professional development in education within the clinical and paraclinical environments are a key concern for healthcare service providers. Effective education, implementation and management of new technologies within the healthcare environment prove to be an essential component as well as an evolving continuous practise for health care service managers when attempting to improve on current operational processes. This reinforces the significance of this current research study to be done.

2.6 Reasons to focus on Technology acceptance within the medical imaging environment

The technology acceptance model (TAM) was constructed to better explain user behaviour over a wide range of end user computing technologies. TAM was developed from the Theory of Reasoned Action (TRA) which focuses on attitudinal explanations regarding the intention to use specific technologies and or services. Rahimi et al., (2018) further explains that the TAM postulates that a user's attitude towards the use of such new technology is therefore determined by two factors which are the perception of usefulness and the ease of use of such new technology. With the aforementioned attitude there is a direct influence in a user's intention to use technology. Perceived usefulness (PU) may be considered as the degree of which a user believes that using a new technology would enhance their job performance whilst perceived ease of use (PEOU) is the degree to which a user is of the belief that using a particular technology is devoid of physical and mental effort.

2.7 Optimizing productivity

Nguyen, Fujioka, Wentlandt, Onabaio, Wong, Bhatia, Bhattacharyva, and Stamenova, (2020) argue the point that although interviewed individuals who had previous experience and/or a basic understanding of technologies within the healthcare environment, the level of exposure to such technologies varied and as a result a certain

proportion of the participants were unable to provide the intrinsic feedback regarding department technological aspects. Groped into that, in this study the inclusion of participants with such a wide range of experiences regarding new telehealth which mirrored the exposure that such technology users would face in the day-to-day clinical environment globally. This Nguyen et al (2020) study focuses on the importance of understanding the complexities faced by healthcare and health administrators. Findings are that administrators vary in perceptions of usefulness and ease of use regarding new technologies within the respective paraclinical environment since such individuals are directly involved with evaluating, procurement and coordination of new technologies.

The findings of the Nguyen et al (2020) research prove to support previous research regarding the utilisation of technology within the paraclinical environment specifically with respect to its potential in order to support the improvements towards the access and to the improved quality of care. The insight provided by participants and their orientation towards the broad challenges faced in the field have the potential to assist and inform health technology implementations in future. The results obtained from this study demonstrate that technology is designed specifically to address the particular challenges regarding palliative care delivery specifically focusing on put patient access and insufficient knowledge of such care practises have been viewed as useful among providers and administrators alike. However, it is further stated that the ease of using such new technologies may influence the user's intention to adopt. Lastly, the users' consideration for the patients' needs does require further research which focuses on exploring the key factors which influence a patient's acceptance of these new technologies and how such technological advancements are capable of interfacing and cross communicating with both clinical and patients.

It is understood that the needs and conditions of such care-based services will differ between regions. Therefore, the observations from this study offer a sufficient starting point in order to better inform the implementation of such new technologies. Empirical research can potentially provide the required support for the future expansion of such care-based operations.

2.8 Optimizing efficiency

Baccei et al., (2020) discuss how efficiency is optimised when utilising the lean methodology within the context of medical imaging. the evaluation of musculoskeletal radiology clinical workflow performed by lean process improvement specialists prove that the implemented changes who significantly beneficial in order to optimise efficiency. Upon the implementation of various modifications to the workflow at a single academic centre it was found that noticeable improvements in efficiency, satisfaction productivity and operational costs were observed. The results reflected that a decrease in the average turnaround time was the result of the successful implementation of workflow modifications. further observed in this study reported high rates of procedural efficiency. To summarise, it has been perceived that improvements regarding clinical efficiency is influenced by such variables which involve technical and clinical factors.

Enhancing the operations within the medical imaging environment by using lean management strategies has been seen to be essential in order to improve on best patient care practises within the institution. Improving on the medical imaging scheduling and technologist workflow proved to have a positive impact on efficiency and productivity with noticeable reductions in waste time and costs (Baccei et al., 2020).

Pesapane, Codari, and Sardanelli, (2018) elaborate that certain new technologies within the medical imaging environment will have a significant impact regarding the optimization of operational performance and maybe more quickly adopted within medical imaging then other medical fields as such implementations of new technologies hold the potential to change medical imaging practises fundamentally. as the medical imaging environment has been identified as the play field of technological development, it is pertinent that continuous education and communication with regards to new medical imaging technologies is performed on a continuous basis. uses of such new technologies do not need to be concerned with the intricate details of such new advancements and systems however all required to retain a basic understanding on the technical vocabulary moving forward.

2.9 Improvements to healthcare

Regarding such required improvement, Alqudah et al.,(2021) provides a comprehensive understanding of the various factors which effect the use of healthcare technologies has been a topic of extensive studies over the last 10 years. Many of these factors were researched using the different technology acceptance models and supporting theories. provided through this systematic review is an understanding as to what effects new healthcare technologies and services and conceptualises the various trends in such large-scale research.

These significant findings confirmed that TAM and UTAUT remain the two most prevalent models when explaining what affects the acceptance of such new healthcare technologies through many different user groups, clinical settings, and geographical locations. Both constructs prove to support the claim that computer self-efficacy, innovativeness, anxiety and trust or leading influential factors which affect the adoption and successful implementation of new healthcare technologies.

As these factors are implicitly internal from the perspective of a user of technology, the research will be conducted only from the framework of TAM in order to answer the research objectives.

The research of Alqudah et al., (2021) has made a significant positive contribution towards the understanding of the large number of theoretical contributions and implications by exploring the potential of technology acceptance within the healthcare industry and further providing a passage for future research opportunities specific to this field.

2.10 Optimizing business process/ enhancing performance

Gomer et al., (2020) focuses on the optimization of business process and performance enhancement within the healthcare context by researching hospital employees who use HIS. the findings reflected that hospital employees hold a hi intention to use such new technology as it is deemed useful and is perceived to make significance improvements in improved productivity, performance, and speed of task efficiency. the research

indicates that in order to assist such adoption of new technology and increase the intention there off it is required that various mandatory trials, product training user socialisation and joint participation between end user and HIS IT personnel is essential for the purposes of assisting end users continuously improve in the current operational framework with the new technology.

According to Kim, Lee, Hwang, and Yoo. (2015) who identified and verified the factors related to the adoption of mobile emergency medical record system by the healthcare professionals. Results once again indicated that's a greater influence of use and knowledge as well as a greater influence on attitude towards using new technologies regarding the behavioural intention to use. These results indicated that there is a stronger relationship between a new technology and work performance Was associated with a larger influence on the end user's behavioural intention to use. This further indicates that within the healthcare context, the end users intend to adopt and use mobile emergency medical record systems in order to improve on their work efficiency. the study further suggested a new model or the intentions of healthcare professionals to use such technology systems and further reveal that such end users within the healthcare domain had a positive intention to use coupled with positive attitudes towards such new technologies if in the event it will assist with their work performance. However, this newly proposed model still requires it to be verified with a more dynamic range of end users within the healthcare services environment and that the relationship with such factors that had the potential to influence the behavioural intention to use such new technologies and systems again require further research.

Rahimi et al., (2018) via review, reflected that the technology acceptance model initially was applied to only task related Internet Communication Technology (ICT) systems namely electronic health records (EHR). Such systems were linked to educational and informative process is which led to such systems having an impact on the learning and competence which are understood to play critical influences regarding use intentions. As it is the purpose of task related systems to enhance the end users task performance as well as improve efficiency such educational concepts may be anticipated to continue to be a prevailing Force within TAM contextualised in the healthcare services. Clinical

end users are most likely to accept and adopt new technologies if it is perceived that such technologies can assist the end users to improve on their work performance. Furthermore, the development and implementation of internet infrastructures has also facilitated the development of systems and process is within this domain. New technologies within the healthcare environment have assisted with the introduction of new organisational structures and consequently have led to interest in the use of TAM to facilitate various organisational adaptations.

Health care policy makers are still in the decision-making process and debating the reasons as to why institutionalising various new technologies and applications on large scale has been rife with difficulties and the reasons why healthcare professionals have been observed to be either adverse or indifferent two such implementations of new technologies. it is believed that user rejection is a leading factor when regarding the institutionalising of various new technologies and applications. It is fundamentally important that further research examines the affective factors in adopting such technological applications by healthcare professionals. Various other factors associated with the adoption of new technology in the healthcare context include subjective norm, security, accessibility, and self-efficacy.

The systematic review reflected that between 1999 and 2016, ICT related healthcare applications were the most frequently studied application using TAM. This implies the acceptance of telemedicine technology during this time period, was considered challenging for healthcare service organisations.

With regards to the increasing number of new technologies becoming prevalent within the healthcare environment, the use of there is technology acceptance models is required to guide the implementation process through the health services context and end user groups. the research further indicates that the continuous progress in availing various new aspects which are critical for ICT implementation hold significant influence on health care services, processes, and outcomes

2.11 Enhancing company performance and competitive position

Fernández and García, (2020) aimed the review with the intention to evaluate the impact of business process management (BPM) methodology in the healthcare arena. The findings suggest that BPM is a worthwhile tool when redesigning the clinical process in order to achieve improved optimization and simplifying workflows.

Furthermore, to assist with the standardisation of various identified processes which hold a high grade of variability, BPM assists effectively in detecting operational weaknesses but have the potential to slow down or make such operations fail. ICT's play an important role in the enhancement of BPM as it allowed a range of value adding functionalities. Various BPM's which have been integrated with new technologies have brought forth the development of clinical decision support systems in order to assist in expedited clinical decision-making processes. Such findings further support the use of BPM methodologies within the healthcare services industry. Such BPM applications is heavily reliant on the involvement and collaboration by all parties involved. in certain instances, within the studies involved, it is apparent that there is a degree off reluctancy to accept such proposed changes based either on distrust of such methodology or disagreement. BPM presents as a continuous improvement methodology; the repetition of its life cycle provides significance to its strategy.

2.12 Improving on customer relations

Nguyen et al.,(2020) reflects that a volume of previous studies indicates that telehealth technologies within the palliative care industry are found to be feasible and further improve the quality of care. The perceptions of healthcare administrators have in fact not been deeply explored within the context of the palliative care industry and yet such key persons are deeply involved alongside the vendors and service providers of new technologies.

The findings reflected that participants feedback was mostly centred on the usefulness of new technology specifically to its capacity in order to support improved access to and the integration palliative approach towards the standard care for individuals with life limiting conditions. Responses further focused on various key considerations towards supporting the ease of using new health technologies amongst patients and technology

vendors in palliative care. A critical focal point within this study was the enabling of remote connection in order to facilitate time efficient access to palliative care services. healthcare service providers and the new technology vendors both agree that the adoption and implementation of such new technologies and web-based applications have the potential to circumvent various challenges in the healthcare service industry and further support effective quality of care services.

The participants further highlighted the importance of ensuring that new technologies oh capable of integrating with existing technology systems to support its ease of use. Technology vendors and service providers considered this crucial as they identified the burden of such new technology introductions as an addition to the already time-consuming operational practise. end users of these new technologies and their attitudes towards the intention of using such technology where significantly influenced by its capacity to integrate with existing health technology systems in order to enhance productivity and operational workflow without imposing further additional work processes.

The findings of this research were found to be similar and in support of previous research on technology utilisation in such healthcare services. The results demonstrated that such new technologies designed were to specifically address the various challenges within the context of palliative care delivery are considered to be the most useful among technology vendors and administrators. The ease of adopting and utilising such new technologies influences the user's intention to adopt.

2.13 Adoption of new technology in medical imaging environment

Nadri, et al., (2018) aimed their study to determine the adoption of the TAM2 model by users' HIS within the paraclinical environments and to further investigate factors of adoption and use of such technologies.

With a total of 270 users which were identified to be eligible for inclusion in this research, the research population itself consisted of the staff compliment of nutrition, and radiology departments.

The data analysis was performed by structural equation modelling (SEM) which is a statistical method that combines both factor and path analysis in order to provide the reconstruction and further analyse the relationship between variables. a total of 10 hypotheses were proposed and investigated Based on the TAM2 constructs originally developed by Venkatesh and David. Subject to the norms are considered to influence a user's intention to use a system. Is in the event a user is of the impression that a system is it necessary this user will make use of such systems and technology as normally expected. TAM2 Indicates that subjective norms have the propensity to influence the intention to use through perceived use (PU) which is deemed an internalisation process. Furthermore, when practising such behaviours expected by group norms, an individual may gain support of the group and society which may further enhance entire group performance. Users of such technologies may further enhance their work efficiency if in the event they have comprehensive knowledge and understanding regarding their job-related knowledge. It may be further inferred that job relevance may have a direct influence on perceived use (PU). In the event that's a user considers such new technologies and systems to positively contribute towards the execution of tasks and work functions they may most likely perceive an improvement in work efficiency.

The implementation management and adoption of healthcare information technology has the potential to effectively reduce healthcare costs whilst enhancing overall quality of service. this case study has contributed positively towards the study of adoption of HIS by applying TAM2. As addressed by this article, the number of studies conducted in various paraclinical departments is minimal. The results of this study indicate that HIS should be adaptable to make considerations for the processes and populations of various departments within the healthcare services industry. Further studies are considered to be required regarding the acceptance of HIS within specific context of each paraclinical department. This study and the results thereof reflected that cognitive instrumental processes appear to be more important than various social influence processes within the context of paraclinical departments which currently utilise HIS. The findings provide useful information regarding HIS service providers, and policymakers in order to develop the strategies and policies for the successful implementation, and

management regarding the adoption of new technologies within the healthcare services environment.

Pan, Ding, Wu, Yang, and Yang,(2019) discusses from a theoretical viewpoint that the contribution of the study towards IT acceptance is complex and multifaceted. The study has made additions to the current knowledge in the fields of acceptance and implementation of healthcare IT, However the authors do believe that more focused and relevant research regarding the adoption intention and usage behaviour towards new technologies within healthcare services is worth making. Furthermore, the study provides partial evidence regarding the need to incorporate various moderate variables in order to best increase the explanatory value of such theoretical models such as differences between departments should be further scrutinised and acknowledged in acceptance models within the healthcare services context.

2.14 Diffusion of innovations

Balas and Chapman, (2018) discuss how such new technology and innovation are slow to disseminate in certain instances. It has been observed that technology vendors and end users are quick to adopt new technologies that appeared to provide relevant clinical innovation based upon a single clinical evaluation. Adopting new technology and innovations without the appropriate scrutiny and practical testing applications is considered problematic. To address various issues of technology malfunctions the authors review examples and suggest frameworks required for the diffusion of such knowledge leading to the adoption of useful innovations.

It is considered helpful for management practises to develop and implement general measures regarding the capacity to change as opposed to various measures which set benchmarks with inpatient healthcare environment. Without such measures, it may be considered challenging to improve on various processes. Such change management may be more pertinent to policy makers for future considerations. As both healthcare service providers and patients continue to rely on established channels of innovation dissemination that were originally designed to serve the average. Future considerations

may need to be aimed at individual needs of such advanced technologies and information as technologies that accelerate dissemination knowledge transformation and responsiveness have the potential to further enhance overall healthcare operations performance and effectiveness. Effective methods for transferring knowledge throughout clinical and paraclinical departments has largely been based in the implementation and management of computerised electronic health records (EHR).

EHR's Have contributed significant success factors which include the automatic provisioning of decision support which forms part of the clinical workflow, the delivery of recommendations, the provision of decision support at point of care to name a few. The lack of interoperability among EHR's is understood as a barrier to the dissemination of knowledge which requires attention to focused on developments and implementation standards in order to best support the sharing of best practises.

2.15 Behavioral adoption theories

2.15.1 Theory or reasoned action

Nisson and Earl, (2016) point out that the theory of reasoned action was developed in the field of social psychology. Developed in the late 1960's, the theory was successful to prove that an individual's behaviour is attributed to attitude either directly or indirectly.

The above assists the researcher as the theory of reasoned action takes into consideration, the individual actions of adoption or rejection of new technologies depends on the individual user's personal attitude towards such new technologies. The construct of the Theory of reasoned action follows a path to that of the TAM where attitude towards use of technologies has been proven to positively influence on the user's Behavioral intention to use such technologies.

2.15.2 Theory of planned behavior

The theory of planned behaviour (TPB) is in addition to the theory of reasoned action (TRA) which was further extended by the addition of knew constructs of perceived behavioural control. this extension was theorised to be the additional determinant of intention and behaviour. TPB was successfully applied to the conceptualising and understanding of and individual's acceptance and adoption of different technologies. the theory is moderated by 3 constructs:

1. attitude towards behaviour
2. subjective norm
3. perceived behavioural control

Innovation diffusion theory (IDT) was developed by Rogers in the year 1962 and is one of the oldest social science theories develop to study innovations. The theory was born from the result off various diffusion studies performed in the 1950s which focused on and individuals' differences in innovativeness.

The proposed four major factors for determining behaviour are the following:

1. Innovation
2. Time
3. Social systems
4. Communication channels.

Rogers, (1995) explains that diffusion is the process in which and innovation is communicated through certain channels over time among members of a social system. Innovation being the ideal practice and/or objective perceived by an individual. Communication is the process which leads to the creation and sharing of information with others in order to reach a mutually common understanding.

Further stated by Rogers is that there are five innovation attributes which have an effect on and individuals' behaviours and can explain the rate of innovation adoption.

These attributes are:

1. Relative advantage
2. Compatibility

3. Complexity
4. Trialability
5. Observe ability

Regarding the application of innovation diffusion theory within the information technology field, it is understood that IDT proves to be a sufficient application when studying the adoption evaluation and implementation of new technologies.

The decomposed theory of planned behaviour (DTPB) Discuss is attitudes towards behaviour, subjective norm, and perceived behavioural control into multi-dimensional believe constructs within the context of adoption of new technologies. It is an extension of TPB which was originally an addition to the TRA. DTPB Has expanded upon the TPB with the inclusion of three factors from the innovation diffusion theory (IDT).

These three factors are as follows:

1. relative advantage
2. compatibility
3. complexity

According to Taylor and Todd, (1995) examination of TRA, TPB and the DTPB provided findings that the TRA and the TPB pose as successful instruments in predicting behaviour. However, DTPB did prove to be effective when explaining behaviour.

The extended technology acceptance model (TAM2) Specifically developed for the information technology arena in 2000 by. Venkatesh and Davis, (2000). The extension was in order to further explain both perceived usefulness (PU) and perceived ease of use (PEOU) from point of social influence and cognitive processes.

Social influence processes are hereby referred to as the following:

1. Subjective norm
2. Voluntariness
3. Image

Cognitive instrumental process is referred to as the following:

1. Job relevance
2. Output quality
3. Result demonstrability
4. Perceived ease of use

The extensions were proposed to successfully enhance the performance to the model. Specifically, in the TAM2 model, experience is moderated and therefore reflects the increase in the level of a technology users experience over a period of time and as such, this may create a change in technology acceptance in the user.

Given the information provided throughout the research provided in the above, one may gather an understanding of the various factors that are faced within the medical imaging community regarding how new technologies affect and effect operational staff in their day-to-day service to the communities they serve. Acceptance of new technology may not be a given factor due to the introduction of new technology; new technology may need to offer users a contribution of benefit which enhances their operational process and further, be required to improve on current operational standards in a manner in which reflects a positive contribution to both user and service to the operations of an organisation.

As established in 2.2 “Noticeable improvements in efficiency” TAM specifically addresses the personal factors which are for the purposes of researching the motivations or hesitancies as to why a user would either accept or reject new technologies. The benefit of using TAM in this research study is in order to ensure that the research utilizes the best model in which the researcher is able to apply the TAM model to the specific context of the individual perceptions of medical imaging operational staff and to further gain insight of how such operational staff accept or reject new advanced medical imaging technologies.

2.15.3 Theory of the Technology Acceptance Model

TAM model

The models of technology acceptance have been developed from the origins of a psychological theory that is able to describe the behaviour off technology users. these theories are based on attitude, intentions, as well as the relationship of technology user behaviour. technology acceptance models assist with the explanation of the various Behavioural factors of new technology users regarding their acceptance, adoption and utilisation of new technology.

As discussed in Chapter one, it has been established that the Technology Acceptance Model (TAM) reflects that a variety of variables may influence the end user's perceptions, attitudes and behavior when engaging with new technologies. The TAM model has been widely utilized throughout many industries and various adaptations to the original construct have been made over time within context to specific operational and technology adoptions. The researcher focuses this study purely on new advanced medical imaging technologies within the medical imaging healthcare services sector.

2.16 THE RESEARCH FRAMEWORK

2.16.1 THE ORIGINAL TAM VARIABLES

Li, Qi and Shu(2008) introduces the classical technology acceptance model which comprises of two main variables. the perceived ease of use (PEOU) and the perceived usefulness (PU).

External variables have an effect on the attitude towards using (A) and behaviour intention (BI) through PEOU and PU which has an effect on use (PU) of new technologies. Variable selection often depends on the specific research domain. PEOU is the extent to which a user anticipates the new technology two require little to no effort

and the PU is a technology users' subjective probability that using a specific technology will increase job performance. subjective norm (SN) is understood to be the individual's perception of social pressure to engage or abstain in the desired behaviour.

Dependent variables being AT, BI, and U are considered to be the main variables in the technology acceptance model however do not always appear in each model unilaterally. BI or combinations of BI and AT are more commonly observed in research models. attitude is the end users feeling about the use of certain mu technologies and attributes thereof. In TAM, AT is the direct connexion between the belief variables PEOU, PU and behavioural intention BI.

Behavioural intention being the occurrence of a technology users' internal cognition about the likes and dislikes with regards to using new technology. Perceived Use (PU) is the last point of technology usage behaviour. Control variables have a significant effect on the prediction ability of a model.

2.16.2 EXTERNAL VARIABLES

External variables have an important effect on TAM, but there are no distinct modes for control variable design. Not all TAM research models have used external variables, although this current one did identify some independent variables to be considered.

2.17 CHAPTER SUMMARY

The literature review considers the most important and more commonly used technology acceptance theories from a technological and behavioural context. Throughout the literature it may be clear that the various theories end adaptations of the model have certain similarities in structure however it differentiates dynamically in their respective context which further aid to the differentiation and explanations provided towards usage of technology and human behaviour. In addition to the aforementioned it may further be deducted that there is still a further requirement for future development

of the technology acceptance theories for the purposes of creating a more efficient theory. This will serve to better enable contextualising a technology's uses and the behavioural intentions that will enable a user to adopt such new technologies, specifically in the medical imaging health care sector.

CHAPTER 3 RESEARCH METHODOLOGY

3.1 Introduction

Chapter Two has described the Technology Acceptance model and the variations thereof which are widely used to measure the successful adoption of new technological implementations. Furthermore, how the correlation of various perceptions may be influenced by a user's perceptions of usefulness and how the perceived ease of use (PEOU) plays a significant role in the manner in which a user intends to adopt or reject technology.

The research of technology acceptance in the medical imaging environment occurred by surveying the medical operational staff members in the private healthcare medical imaging services sector on their perceptions of new advanced medical imaging technologies. Through this research the identified variables will be statistically analyzed in order to provide insights regarding the perceptions of new advanced medical imaging technologies from the perspectives of the operational staff.

Within this chapter, the researcher elaborated upon the research concept, design, and the problem statement and further evaluated the various research approaches which best fit the research study. The research model, data collection techniques and statistical analysis are discussed below and furthermore, the reliability and validity of such statistical findings.

Naidoo, (2011) discusses that research may intend various outcomes which assist to generate a model or theory. However, various research orthodoxies should be avoided where possible. Within the context of healthcare research, Positivism is a commonly used research paradigm as this may be due to a stern biomedical influence of the under-graduate emergency care training. Naidoo (2011) stated then that there is a need for qualitative research within the healthcare context as this may provide insight to

various marginalized groups within the industry. Research designs are to conceptualize the framework of such studies.

3.1.1 The concept of research design

A plethora of definitions are available to conceptualize research design. As stated by Islamia, (2017), design infers the process of outlining and arranging the study details. Research design is seen as the preparation of the study strategy for conducting research. The work of research design therefore begins after the identification of the problem and concludes before data is collected. The gap between these two points is sought to be bridged with the research design. It may therefore be stated that research design should contain the detailed information of the research topic, the research objectives, concepts and definitions, various hypotheses, the method of data collection and data.

3.3 Problem statement

Medical science literature has indicated that the introduction of the various new advanced medical technology is often met with employee resistance as reported in the literature of Ileri and Arik, (2018). Such employee resistance often relates to the process of how management has implemented and managed the introduction of new technology further elaborated upon by Strohm et al., (2020). This study was motivated by the paucity of research within the radiography context specifically regarding the adoption, implementation, and management of advanced medical imaging technologies. The study investigates new advanced medical imaging technologies and the acceptance thereof in the medical imaging environment and the resistance of adoption of new advanced technologies of the radiographers. The research sought to assist healthcare management by identifying various factors that may influence the implementation of new technologies within their businesses.

3.4 Methodological Research approach

3.4.1 Research Methodology

The study was located within a quantitative positivistic paradigm. In that, the researcher was able to gain an understanding of the human behavior via observation and reason. According to Park, Konge and Artino, (2020) the history and definition of positivism suggest that Positivism relies upon Hypothetico-deductive methods in order to verify a hypothesis which may be stated as quantitative and when various functional relationships may be further derived between independent variables and the dependent variables. A leading factor for positivist studies is that through positivist research and experimentation, the researcher is able to identify and control the influence of all the factors involved in order to ensure that only the key variables which are of interest are studied. This was applicable for this TAM research study.

3.5.2 The positivistic approach

Lan, (2018) elaborates that positivism suggests that science is the only valid form of knowledge and that factual findings are the object of knowledge. The main task of philosophy is to bring forth principals which are common in science and use such principals as guides to conduct and as the basis of social organization as philosophy did not hold any methods which differ from science. Lastly, Positivism did not acknowledge prior reasoning and or theological or metaphysical knowledge. As the research sought to measure the perceptions of new technologies in the medical imaging services environment from the perspective of the end user, such an approach may fit the study due to its foundation in a science-based approach.

3.4.3 The interpretative approach

With regards to the interpretive research approach, it may be doubtful whether there exists the possibility to always establish cause and effect between variables within

social sciences. From the work of Lan,(2018) it was clear that the interpretive research approach is used to gain clarity and knowledge related to human and social sciences. This may not be similar to its use in physical science as humans interpret their perception of the world and then act upon such interpretations whilst the world does not. Interpretivists adapt a relativist ontology whereby a single phenomenon may hold many interpretations over that of a specific truth that may be determined by a measurement process. From this perspective, the advantages of this approach were that with various views which look into phenomena, interpretivist research can describe events, objects and humans and further understand how such constructs are understood in a social context. This interpretive approach may offer benefits in the understanding of how users perceived benefits derived from new technologies or reflected their hesitancies toward new technologies. From such an approach, the researcher may have been limited in the intentions to identify and measure the variables to which end users accept or reject new technologies due to this approach not being established in a purely science-based paradigm. Therefore, it does not apply to this current research study.

3.5 Qualitative and Quantitative research

3.5.1 Qualitative research

Described by Creswell,(2014) qualitative research is the approach for understanding individuals or groups ascribe to the social or human issue. The research process involves emerging questions and data which is collected in the participants setting. The data is analyzed inductively and builds from particulars into general themes. The researcher then makes interpretations of the meanings of the data. The final reporting of the data is flexible and those who wish to engage in this inquiry support a way of observing the research that honors an inductive style. This is therefore not applicable to this current research study.

3.5.2 Quantitative research

Creswell, (2014) further states that Quantitative research is an approach for testing objective theories by examining the relationship amongst the variables that are them measured on instruments on which the numeric data may be analyzed by use of statistical procedures. The final reporting may then consist of a set of structured data consisting of introduction, literature and theory, methods, results and future discussion. Similar to qualitative research, those who engage in this form of inquiry hold assumptions regarding testing theories deductively which build on protections against bias and controlling for alternative explanations whilst being able to generalise and replicate findings.

3.5.3 Quantitative versus Qualitative research

Quantitative research is often associated with positivism whilst qualitative research is associated with interpretivism. It is possible to indicate whether research leans toward a more qualitative or quantitative nature.

As indicated by Atieno, (2009) a disadvantage of a qualitative approach is that the research findings extended to broader populations holding the same degree of certainty which quantitative analysis con offer. This is due to the fact that the findings of the research are not tested to discover whether they are significant or by chance.

Rahman, (2016) elaborates that quantitative findings are more likely to be able to be generalized to a whole population or group as it involves the larger randomly selected sample. Added to this, data analysis and statistical information benefits the study in providing a science-based validation of the findings and provides credibility to the study.

This research seeks to offer science based factual insights which are able to be easily replicated in future throughout medical imaging services practices in the region of South Africa. It is therefore seen as imperative by the researcher that a purely quantitative approach is necessary for the intended study.

3.6 Selecting the appropriate method of research

Through the understanding of the problem, it may be deduced that this research study adheres to quantitative research methods as the research supports deductive reasoning and analysis of findings. Furthermore, this research project adheres to clearly defined themes in order to solve the research problems via the process of investigation and analysis.

As this research project intended to explore the perceptions of medical imaging operational staff on the subject of new advanced medical imaging technologies. The researcher has made use of the original TAM construct and identified variables obtained in chapter two in order to gain insight on the importance of understanding the perceptions of medical imaging staff and their respective positions regarding the future changes in the medical imaging environment. This research project also wished to further contribute towards the body of research of technology acceptance within the medical and healthcare services industry.

The goal of this research is to provide broad managerial insights regarding the implementation and acceptance of new advanced medical imaging technology.

The researchers intention was to accomplish the goal by gaining insights to the perceptions of radiographers with regards to the implementation of such new advanced technologies within the medical imaging environment. With the opportunity to survey operational staff members (radiographers) within the imaging environment, the researcher sought to gain further insight regarding their knowledge of such new advanced medical imaging technologies.

Further to the above, the researcher wished to gain knowledge of the perceptions of the radiographers on what they thought of advanced medical imaging technology, gaining clarity of the end users' perceptions. The researcher then attempted to gain insight as to whether such operational staff believed that new advanced medical imaging technology may be capable of enhancing their operational efficiency or whether such

advancements would offer challenges in the imaging environment. The researcher then attempted to determine whether operational staff would accept or reject such advance imaging technology based of their respective attitudes to the new technology. Lastly, the researcher aimed to assist healthcare management to determine the best practices regarding the implementation processes of new advanced technology from the perspective of the operational staff involved.

3.7 Strategies used for the research

Daniel, (2016) outlines the advantages of quantitative research where the use of a statistical tool assists in saving resources and time. Arguably, such an approach relies heavily on of statistical data for analysis and interpretation. Furthermore, such methods of data collection and analysis thereof alloy generalizations possible. Another advantage of such a strategy is that replications of the research may be developed and deployed as the research relies on hypothesis testing. Such research using quantitative methods and strategies is applicable to the public and various groups thereof. For the purposes of this research project, the researcher will focus on a general research strategy in order to determine the perceptions of radiographers regarding their perceptions of new advanced medical imaging technology.

3.8 The population

The sample was randomly chosen from the total population of 322 operational personnel within the organization, based on the information given to the researcher by the practice manager. Radiographers who are at the heart of the medical imaging operation are therefore the focus sample group within the population.

A total of 50 to 70 surveyed responses was sufficient for the purposes of providing statistical data in order to perform a Pearson Correlation Coefficient statistical analysis. As the researcher wished to make use of the gathered nominal data derived from the

electronic questionnaire in order to observe the correlation between the factors. This provided insight regarding the perceptions of medical imaging service staff towards the adoption or rejection of new advanced medical imaging technology.

Gravetter and Wallnau, (2017) state that Pearson's Correlation measures the strength of the relationship between two variables. It must be noted that with a larger correlation, the stronger the relationship. A Pearson Correlation measures the degree of the relationship between two variables on a scale ranging from minus one (-1), zero and plus one (+1) to show a negative, neutral or positive relationship.

As this research sought to gather insight of the perceptions of medical imaging service staff specifically through the construct of TAM, the researcher intended to investigate the significance between the factors of Perceived Usefulness (PU), Perceived Ease of Use (PEOU), Behavioral Intention to Use (BI) and Attitude towards Use (A) of future new advanced medical imaging technologies.

3.9 The empirical study

The electronic questionnaire was constructed using the TAM model elaborated upon in chapters one and two. The questions were then formulated with the objective of gaining insight to the radiographer's perception of new advanced medical imaging technologies within the imaging environment and how such technologies may be seen as beneficial or challenging.

3.10 Research Design

According to Islamia, (2017) research proves its validity when the conclusion is accurate or found to be factual. The research design is the conceptual framework or “blueprint” within which the research is conducted. Therefore, research design can be considered as the framework of research that binds the elements in a research project together.

From the above definition it is plausible to define research as the preparation of the action plan which is focused on arranging and integrating data into a framework which seeks to solve the research problem. Research design therefore may be considered as the concept in which research is conducted consisting of three main elements:

1. The framework for data collection
2. Measurement
3. Analysis of the data

The research design should be anchored in and should be constructed once the topic and problem statement of the research have been formulated accompanied by the outlined objectives and the concepts have been defined. furthermore, that the hypotheses have correctly framed and that the research design is capable of providing answers to the following:

1. What the study is about.
2. What data is required.
3. The purpose of the study.
4. Where does the study occur.
5. The time limit of the study.
6. The sampling methods used.
7. The appropriate method for data collection.
8. How data will be analysed.
9. The nature of the study.

3.11 Measurement of constructs

With use of the electronic questionnaire, the researcher aimed to derive statistical information that will assist in validating the below hypotheses.

The design of the electronic questionnaire is of the nature that the questions encompass the following hypotheses. The design of the electronic questionnaire will follow TAM for all Hypotheses other than that of the first proposed hypothesis H_1 which proposes that Perceived Usefulness (PU) may have a significant effect on Perceived Ease of Use (PEOU). This is contradictory to the original TAM construct as indicated in previous research and the statistical findings of Davis 1989. However, the motivation to determine whether such an effect may exist in the context of this study is born from the research objectives in which the researcher wishes to answer the question of whether medical imaging operational staff perceive the usefulness of new advanced medical imaging technologies to offer ease of use in their day-to-day operational service activities.

Therefore, the research Hypotheses made use of the original TAM construct and further test weather radiographers may perceive that new advanced medical imaging technologies of the future may offer a desired Perceived Ease of Use (PEOU) within the context of medical imaging.

3.12 The Conceptual model

External variables are identified as new advanced medical imaging technologies designed for the medical imaging services business practice inclusive of the following variables:

- New Medical imaging equipment.
- New medical imaging technologies

Perceived usefulness (PU) is identified as the user's perception of the beneficial usefulness attributed to the new features and practical advancements of new medical imaging technologies of the future within the medical imaging operations environment. Such technologies which are perceived to offer the user the benefits of the following variables:

- improvements in operational methods
- Improvements to healthcare standards.

Perceived Ease of Use (PEOU) is identified as the user's perception of the functional and operational benefits of new medical imaging technologies and equipment which may offer the user's the benefits of the following variables:

- Optimising business performance standards
- Reductions in operational wastes
- Improving customer relations both from an imaging services business perspective and from a healthcare services provider to the patient perspective.
- Improvements image quality
- Improvements in operational functionality

Behavioural intention to use (BI) is identified as the user's perception of the advantages or disadvantages regarding the implementation and use of new advanced medical imaging technologies and equipment which may offer end user's the following variables:

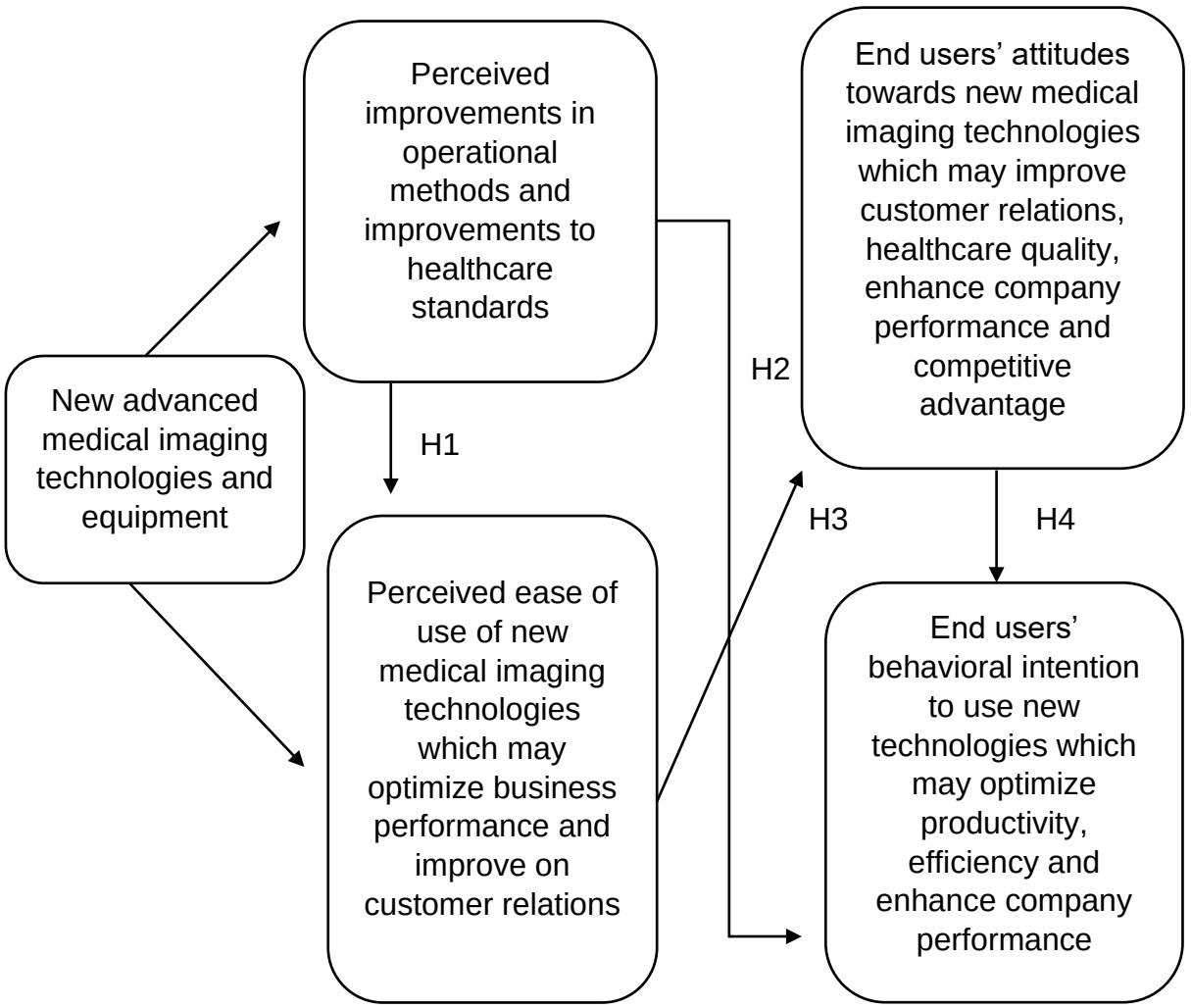
- Optimisation of efficiency in the medical imaging services process
- Optimising productivity within the medical imaging services environment
- Enhancing company performance

Attitude towards use is identified as the user's attitude towards the use of new advanced medical imaging technologies in the medical imaging environment which may contribute toward the following variables:

- Improving customer relations
- Improving on the quality of healthcare standards
- Enhancing company performance and competitive advantage.

The discussion above can be illustrated in Figure 2 below.

Figure 2: Adapted Technology acceptance model inclusive of the identified variables



The Conceptual model is an adaptation of the Technology Acceptance model proposed by Davis (1989), inclusive of the identified variables elaborated upon above (Researchers own construct). The conceptual model outlines the research study aimed to answer the hypotheses below.

3.13 The Research Hypotheses

$H1_0$: Perceived usefulness (PU) does not exert a significant effect on perceived ease of use (PEOU) of new medical imaging technologies. Therefore, the formulated alternative Hypothesis was presented as the following:

$H1_A$: Perceived usefulness (PU) does exert a significant effect of Perceived Ease of Use (PEOU).

$H2_0$: Perceived usefulness (PU) has no effect on the behavioural intention to use (BI) new medical imaging technologies. Therefore, the formulated alternative Hypothesis was presented as the following:

$H2_A$: Perceived usefulness (PU) does have a significant effect on behavioural intention to use (BI).

$H3_0$: Perceived ease of use (PEOU) has no effect on Attitude toward use (A) of new advanced medical imaging technologies. Therefore, the formulated alternative Hypothesis was presented as the following:

$H3_A$: (PEOU) does have a significant effect on (A)

$H4_0$: Attitude towards use (A) has no effect on Behavioral Intention to use (BI) new advanced medical imaging technologies. Therefore, the formulated alternative hypothesis was presented as the following:

$H4_A$: Attitude towards Use (A) does have a significant effect on Behavioral Intention (BI).

The principal objective of this research study mentioned in chapter one is to explore the perception of radiographers regarding the implementation of new advanced technology within the medical imaging business within the private sector.

Secondary objectives that have been identified are:

To survey operational staff members within a medical imaging environment regarding their knowledge of new advanced medical imaging technologies. This facilitated a better understanding of their respective knowledge of new medical technologies and gather further comprehension of such new technologies perceived usefulness in the imaging environment.

To survey operational staff members within a medical imaging environment on what they thought of advanced medical imaging technology in order to gain insight on their perceptions on new technologies and how such technologies may either be perceived as useful or alternatively create various hinderances upon implementation.

To ascertain whether operational staff believed that advanced imaging technology would enhance their operational efficiency thereby further understanding how operational staff felt regarding such technological changes in the imaging environment and their respective attitudes towards the implementation and use of new technologies and their intention toward acceptance or rejection of new and evolving medical imaging technologies.

Lastly, to determine the best practice of technology implementation from the perspective of medical imaging operational staff.

3.14 Sampling

The sample consisted of approximately 50 to 70 operational staff. This excludes radiologists and other staff in the clinical radiography/medical imaging environment such as non-academic radiographers.

From the statistical perspective, the minimum required total number of respondents needed to successfully perform the survey analysis is stated as 50 according to Nihan, (2020).

3.15 Data collection

Shartzer and Sapitula, (2017) state that the methods used for data collection are required to be scientifically valid and relevant to the research study. Questions used in data collection methods such as surveys need to be specific to the context of the study and must be properly defined before a survey occurs. This implies that the design of the questionnaire must meet the requirements of the study being performed.

3.16 Data Collection techniques

Data was collected using an electronic questionnaire. The researcher was made aware that the gatekeeper requires an electronic questionnaire to ensure that operational staff were not hindered by long and elaborate interviews which were needed to occur in working hours and that staff were able to answer questions related to the study in a manner in which the researcher did not interfere with clinical imaging operations. Furthermore, concerns regarding the spread of Covid-19 were prevalent within the environment and therefore minimal direct contact with such operational staff was required for safety concerns of all parties. This was the most appropriate method to use

as the research participants were spread over a wide geographical area, were well educated, and have limited time to complete the instrument. Furthermore, an electronic questionnaire in terms of the literature was seen as beneficial for the following reasons:

The practice management level supported the use of an electronic questionnaire as it was seen as the least disruptive to their business. The researcher was aware that electronic questionnaires have limitations, however, this method of obtaining data was in line with the survey policy of the institution. Furthermore, this method complied with the

Protection of Personal Information Act (Republic of South Africa, 2013) (No 4 of 2013). Due to the of the stringent requirements of the Act, the researcher will not have direct access to the participants. The researcher was aware of the manager's potential role as a gatekeeper, a role that may have had a limiting factor impact on data collection; however, again it complied with the company's preferred way of centralising data collection and minimising employee disruption. Participants were able to submit the completed questionnaire directly to the researcher' s survey tool database but remained anonymous in the reporting structure.

3.17 Survey questionnaire

This study was a case study of a private company but will use the survey method to collect data. From the review of secondary data, a questionnaire was developed as the research instrument. Use was made of an electronic questionnaire consisting of open and closed questions and Likert-type scale questions. The questionnaire consisted of twenty-six questions.

3.18 The surveyed population

The sample population comprised of current operational staff members working directly with medical imaging equipment within the Eastern Cape private sector. The total

potential population was approximately one hundred and ten radiographers in total spread throughout the Eastern Cape region in multiple establishments.

3.19 Statistical analysis

Fraenkel and Wallen, (2009) indicate that the minimum acceptable sample size for a Pearson's correlation statistical analysis is no less than 30 survey participants. Furthermore, data which is derived from a sample which is less than 30 surveyed participants provides the researcher with inaccurate results of the degree of correlation.

3.20 Reliability and validity

There is a broad consensus in research theorists upon the framework of research design. Saunders, Lewis and Thornhill, (2015) elaborate that certain researchers have placed emphasis on the philosophical components research design. Others have made use of more useful and practical frameworks. Validity is concerned with the effectiveness of the measuring instrument. Reliability considered the accuracy of the research. The extent to which upon the repeated measurements, indicators bring forth similar results. Reliability within quantitative research may be repeating certain questions in a survey.

3.21 Reliability of Cronbach's alpha coefficient

According to Collis and Hussey, (2014), reliability refers to the degree at which a measurement instrument is capable of generating consistent results. Leedy and Ormrod, (2015) state that a measurement is considered reliable if the repeated measurement open unchanged entity is capable of returning the exact results each time.

An often-used internal consistency reliability measure within quantitative research involves the use of the statistical technique of Cronbach's alpha in which questions inside a survey are tested statistically in order to determine how accurately they are able to measure variables.

Elaborated upon in the information provided by Collis and Hussey, (2014) infer that for the scale to be considered reliable the crown best alpha coefficient should be greater than or equal to a score of 0.8. Furthermore, scales between 0.7 and 0.8 have been considered to hold good reliability and that scales which hold values between 0.6 and 0.7 indicate fair reliability as depicted in table below.

Table 3: Interpretation intervals for Cronbach's alphas

Excellent	0.80 +
Good	0.70 - 0.79
Fair	0.60 - 0.69
Poor	0.50 - 0.59
Unacceptable	< 0.50

Source: Researchers own construct

3.22 Chapter Summary

The research methodology and method of surveying the population sample and the formulation and construction of the questionnaire have been elaborated upon in this chapter. Such a systematic approach to research remains crucial in order to ensure that

the research project adheres to the principals which ensure accuracy, validity and reliability. The research design will lead the researcher towards efficiently addressing the research problem. As the quantitative approach proved to be the most appropriate research strategy for the empirical study component of this research project, the electronic questionnaire was the main method for data collection.

CHAPTER 4

4.1 Introduction

The previous chapters have introduced the type of research, the research instrument of technology acceptance and the research design. This chapter will present the data collection, response rate, the analysis and the interpretation of the data collected from the survey.

In this chapter, the researcher elaborates upon the data obtained from the population. With the use of exploratory factor analysis, the researcher has successfully derived the statistical findings and tested the reliability and validity of such findings as required.

The questionnaire sub-sections followed the sequence of the questions as they appeared to the sample respondent. It is as follows below:

The first question asks the respondent if they wish to take part in the survey as a measure implemented to ensure that respondents have the right to not participate based on their own personal reasons.

Question two demarcated age of the respondent.

Question three demarcates where the respondent currently operated geographically in the Eastern Cape.

Question four enquired of the length of time the respondent has been working as an operational radiographer.

Question five enquired how many years have passed since their graduation.

Questions six, 13, 14, 15, 22 and 25 measured Behavioral Intention to use new advanced medical imaging technology.

Questions seven, 16, 17 and 19 measured perceived usefulness of new advanced medical imaging technology.

Questions eight, ten, 18, 21,23, 24, and 26 measured the respondent's attitude toward using new advanced medical imaging technology.

Questions nine, 11 and 12 measured the respondents perceived ease of using new advanced medical imaging technology.

Question sub-sections of the electronic questionnaire.

Table: 4.1 The main Sub-sections of the electronic questionnaire

Categories	**Number of questions**
Age	1
Years of service in the medical imaging industry	1
Years since graduation	1
Geographical location within the Eastern Cape	1
Behavioral Intention to use new advanced medical imaging technology	6
Perceived usefulness of new advanced medical imaging technology	4
Attitude toward the use of new advanced medical imaging technology	8
The perceived usefulness of new advanced medical imaging technology	3
Total	**26**

Source: author's own summary (2022)

4.2 Data collection

The survey questionnaire was circulated to the prescribed individuals currently working in the private sector medical imaging services of the Eastern Cape of South Africa by the gatekeeper. The prescribed survey population only included staff members who were working in the medical imaging services within the region which included areas of Humansdorp, Jefferey's Bay, Uitenhage, Port Elizabeth, and Grahamstown. The gatekeeper conducted the dispersion of the survey under the required internal procedure in accordance with the company policy. The sample size was 100 targeted survey respondents, however, a total of 66 questionnaires were completed which indicated a 67.35% response rate. This was an unexpectedly high response rate when one considers the current healthcare industry challenges of very busy professionals.

4.3 Data analysis

The data was firstly scrutinized in order to check the response rate and overall validity. This process was then followed by assessing the reliability of the research which was performed by using the Cronbach's Alpha reliability analysis (Bonett & Wright, 2015). The reliability of the research addresses the findings of the research and establishes the credibility of the research findings. Therefore, research findings are considered reliable in the event that the findings are able to be repeated (Tavakol and Dennick, 2011).

The Cronbach Alpha is used to measure the reliability of a survey instrument and is able to indicate the extent of a set of items may be used to qualify or measure a single variable.

The Cronbach Alpha formula is as follows:

$$\alpha = \frac{N \cdot r}{1 + (N-1) \cdot r}$$

Where:

α = Cronbach's Alpha

N = The number of items

r = The average of all Pearson Correlation coefficients between the items

Cronbach's Alpha will increase in numeric value as the correlation between the items increase. The Alpha value may range from negative infinity to positive one. The closer Alpha is to one the higher the reliability. The reliability coefficient of 0.70 or higher is considered to be acceptable for the purposes of research.

The data derived from the questionnaire was analysed with use of the computer software programme known as Statistica. The analysis of the data what is performed by using the expertise of a statistician provided by the Nelson Mandela university. The total population of the sample resulted in a sample of 66. the online survey questionnaire consisted of two components. the first component consisted of 5 variables addressing respondents age, geographical location, number of years served as a radiographer, and number of years since graduation.

The second component of the survey consisted of a five-point Likert scale which provided the survey respondents to offer opinions within the statements regarding their perceptions of accepting or rejecting new advanced medical imaging technologies.

Fraenkel and Wallen, (2009) state that the minimum acceptable sample size for a Pearson's correlation statistical analysis be no less than 30 survey participants.

Chee and Queen, (2016) state that the Pearson's product moment correlation coefficient is a modern statistical analysis formula which evaluates the linear relationship between variables. The positive or negative direction and strength of such relationship (coefficient of determination) may also be evaluated.

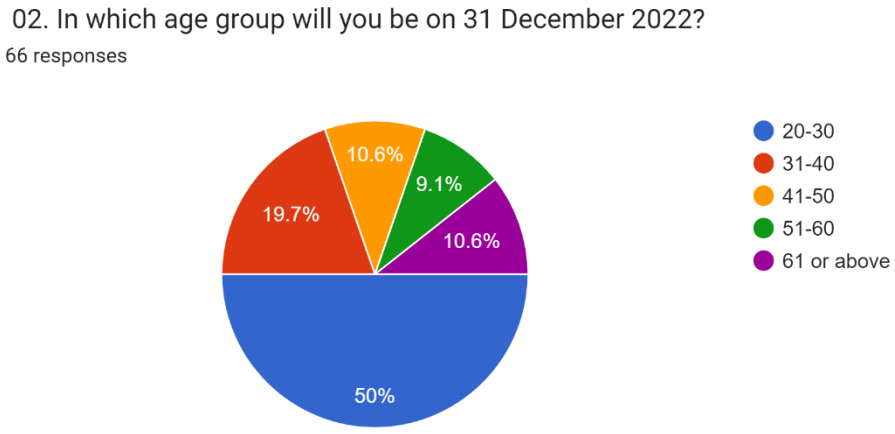
Cohen, (1988) elaborates that the Pearson's Product Moment correlation is a practical way to understand the relationship of variables. The correlation measures the existence of a relationship (presented by the p-value) and the strength of the relationship (presented by the r-value) between two variables. An absolute r-value of 0.1 is categorized as small and an absolute r- value of 0.3 is categorized as medium, an absolute r- value of 0.5 is categorized as large.

4.4 Response rate

All 66 participants completed the survey successfully. Due to the loss of one single participant being excluded from the survey. Sixty-six respondents successfully completed the survey. After further scrutiny from the statistician, it was found that 65 surveyed respondents had completed the survey in the correct manner. One single surveyed participant was excluded as he/she had marked all Likert style answers as "Neutral" and thus the survey response was excluded from the statistical analysis. The "neutral answers" were deemed unfit for further analysis. This could possibly have indicated a reluctance to truly reflect on his or her perceptions regarding the research topic. The useful data was adjusted to n=65.

The second question of the survey demarcates the different age groups of the surveyed population. The largest majority of the population holding fifty percent (33 surveyed participants) are within the age group of 20-30 years old.

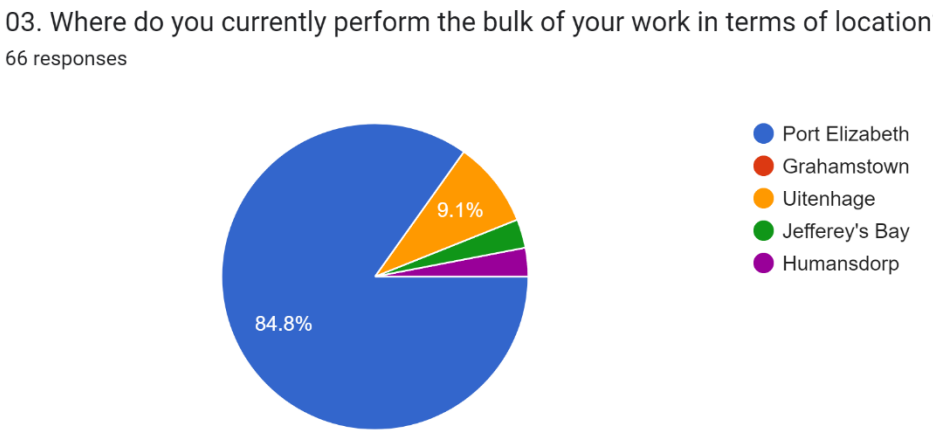
Figure 4.2: Different age group proportions



Source: Information obtained from empirical data collected.

Figure 4.3 expresses the total number of participants currently working at the various locations within the Eastern Cape. Unfortunately, those working in Grahamstown were not willing to participate in the survey. The majority of the surveyed population currently resides and performs their work in Port Elizabeth. It must be noted that the Port Elizabeth region comprises the bulk of Company X's medical imaging operations and further hosts 4 operational medical imaging facilities fully equipped with a wide range of medical imaging equipment. For this reason, it is understandable that the majority of surveyed respondents were derived from Port Elizabeth.

Figure 4.3 Geographical location of surveyed respondents.

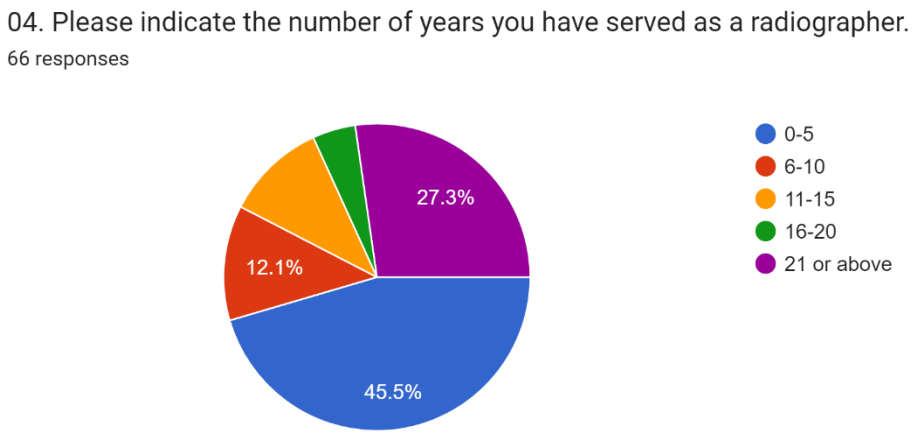


Source: Information obtained from empirical data collected.

Results obtained from the surveyed population reflecting the variance in geographical location in which the surveyed participants currently perform their operational duties.

Figure 4.4 reflects that the largest number of radiographers in the sample who successfully completed the survey have been working as radiographers for a period of under 6 years. The second largest proportion of the sample population reflects that 27.3% of the 66 respondents have worked in radiography for more than 20 years.

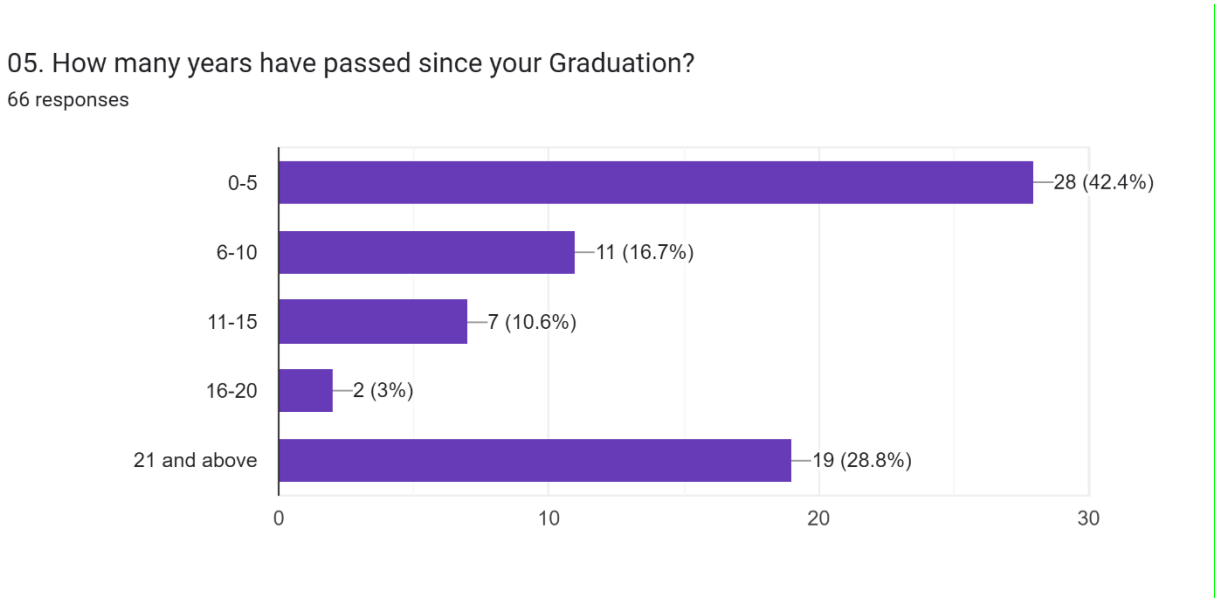
Figure 4.4: Years of operational service of the respondents



Source: Information obtained from empirical data collected.

Results obtained from the surveyed participants reflecting the variations in years of operational service the surveyed members have participated in active duties within the medical imaging services environment

Figure 4.5: Assessment of years since Graduation



Source: Information obtained from empirical data collected.

Results obtained from the survey participants reflecting the sample population's years after the participants graduation.

4.5 Frequency distribution of the factors

Measurement items have been grouped in order to indicate the measure of central tendency. the scoring of the factors has been categorised as per the five-point Likert scale questionnaire bet has been used for the study.

Table 4.2 Frequency Distributions: Attitude towards Use

Frequency Distributions: Attitude towards Use (n=65)				
Item		**Disagree**	**Neutral**	**Agree**
Q 08. I think that new technologies in the medical imaging environment will be easy to learn.	Count	16	5	44
	Percent	24,62	7,69	67,69
Q 10. I think I may require assistance with new technologies implemented in the imaging environment.	Count	7	12	46
	Percent	10,77	18,46	70,77
Q18. I think that as a radiographer, I will be confident in my ability to produce an improved level of service with the implementation of new medical imaging technologies.	Count	1	7	57
	Percent	1,54	10,77	87,69
Q 20. I think that the vendors are highly skilled and proficient in their ability to assist and provide technical solutions in the imaging environment.	Count	3	21	41
	Percent	4,62	32,31	63,08
Q 21. I think that the vendors are providing my imaging facility with the best technologies available in the market.	Count	6	13	46
	Percent	9,23	20,00	70,77

Table 4.2 Frequency Distributions: Attitude towards Use

Q 23. I am confident in the vendor's ability to deliver a professional service such as training, servicing of equipment and maintenance.	Count	1	16	48
	Percent	1,54	24,62	73,85
Q 24. I am satisfied with the experience of using new technologies within the imaging environment.	Count	-	4	61
	Percent	-	6,15	93,85
Q 26. I will continue to make use of the vendors who support such new technologies.	Count	1	11	53
	Percent	1,54	16,92	81,54

The results reflect the majority of the surveyed operational staff members have a positive attitude regarding the new advanced technology in the medical imaging environment. Question 24, which scored the highest result of 93.85% reflects that an almost total majority are satisfied with their current experience of using the new available technologies in the medical imaging environment.

In summary, 81.54% of the surveyed population hold a positive attitude toward the operational benefits and quality improvements that new advanced medical imaging technologies will offer the medical imaging services industry in future.

Table 4.3 Frequency distributions: Behavioural Intention to use

Frequency Distributions: Behavioural Intention to use (n =65)				
Item		**Disagree**	**Neutral**	**Agree**
Q06. I am able to learn the operation of new technology in my work environment with ease. "	Count	12	5	48
	Percent	18,46	7,69	73,85
Q13. I believe that new technologies within the work environment will greatly assist me in performing my duties optimally.	Count	1	5	59
	Percent	1,54	7,69	90,77
Q14. I work better with new technologies currently implemented in the work environment.	Count	-	5	60
	Percent	-	7,69	92,31
Q15. I think that I will become more proficient in my operational requirements with the new technologies of the future medical imaging equipment.	Count	1	7	57
	Percent	1,54	10,77	87,69
Q22. I expect that the new technologies in the medical imaging field may improve the quality of service.	Count	1	3	61
	Percent	1,54	4,62	93,85
Q25. I will continue to use the new technologies implemented within the work environment.	Count	-	4	61
	Percent	-	6,15	93,85

From the data above. The user's Behavioral Intention to use (BI) new technologies reflect that a significant majority of users feel confident with the benefits of new medical imaging technologies. Furthermore, the users are confident in their abilities to adapt to the operational changes and learn how to operate such new technologies in their environment. It is apparent that most of the surveyed sample perceive new medical imaging technologies to hold operational improvement and add to the level of service quality.

Table 4.4 Frequency Distributions: Perceived Ease Of Use

Frequency Distributions: Perceived ease of use (n =65)				
Item		**Disagree**	**Neutral**	**Agree**
Q09. I think it is easy to adapt to using new technologies within the medical imaging environment. "	Count	17	5	43
	Percent	26,15	7,69	66,15
Q11. I think I will require ongoing training on the new technologies implemented in the imaging environment.	Count	8	13	44
	Percent	12,31	20,00	67,69
Q12. I think I may enjoy the improvements in my day-to-day work environment due to the new technologies of future medical imaging equipment.	Count	-	10	55
	Percent	-	15,38	84,62

Table 4.4 reflects that 66% of the respondents think that adapting to new technologies within the imaging environment will be easy, 7.6% were neutral on their ability to adapt

and a further 26% disagreed with the notion that adapting to the implementation of new technologies may occur with ease. Furthermore, 67.69% of the respondents believe that they will require ongoing training of the new technologies implemented in the medical imaging environment. This reflects that most of the respondents and aware and willing to endure further training of future medical imaging technologies in order to derive the most benefit from future systems. A further 20% felt neutral upon the subjects as continuous training is a standard within the healthcare professions. Twelve-point thirty one percent disagreed to the statement which may provide insight as to why some respondents feel that new technologies may be significantly easier to operate that those currently implemented.

The perception of ease of use of new medical imaging technologies reflect that the majority of respondents show a positive perception and eagerness towards the adoption of future introductions of such technologies in the imaging environment. As indicated in the response rate of question 12, the respondents perceive such new technologies to provide operational improvements which results in a direct benefit to users.

Table 4.5 Frequency Distributions: Perceived Usefulness

Frequency Distributions: Perceived usefulness (n =65)				
Item		**Disagree**	**Neutral**	**Agree**
Q07. I think the deep learning (algorithm-based machine learning) advancements within medical imaging improve image quality.	Count	-	4	61
	Percent	-	6,15	93,85
Q16. I think it will be easy to learn how the new technologies operate.	Count	13	9	43
	Percent	20,00	13,85	66,15

Table 4.5 Frequency Distributions: Perceived Usefulness

Q17. I think that the new technologies in future will improve the work environment of radiography.	Count	1	6	58
	Percent	1,54	9,23	89,23
Q19. I think that the vendors of new technologies implemented within my environment are easily contactable.	Count	6	23	36
	Percent	9,23	35,38	55,38

The respondents reflect that the perceived usefulness of such new imaging technologies may likely assist in producing operational improvements. The respondents are also largely adaptable and willing to learn how such new technologies operate and enjoy the derived benefits from future imaging technologies. Although the large majority of the respondents show a positive attitude towards the usefulness of new imaging technologies which reflects a strong level of acceptance and supportive perceptions of end user's towards new medical imaging technologies, vendor support within this field of medical imaging. It may therefore be beneficial for future research to be performed on technology acceptance within medical imaging in correlation with vendor support.

Almost 94% percent indicate that the algorithm-based machine earning advancements within the medical imaging sector may improve image quality and therefore improve the integrity of the study by enhancing quality standards. From the survey, 66% are of the impression that such new imaging technologies will be easy to learn and operate with ease. Furthermore, 89% of the respondents believe that new technologies in future will

improve the medical imaging environment and contribute positively towards operational environmental improvements.

Only 9% of the respondents did not feel that the vendors who support such current technologies and offer new advanced technologies are easily contactable. A further thirty-five percent of the respondents felt neutral in this regard and fifty-five of the respondents felt that vendors of such technologies were easily contactable. This may be as a result of the fact that the majority of the surveyed respondents are operating at a junior level in the organisation and there are policies in place regarding reporting structures in order to address machine faults, system downtimes and various related technical instances. This may also pose as a topic for future discussion as to what external factors may influence operational staff being able to contact vendors for support or technical assistance.

4.6 Results of the validity and Reliability analysis

Exploratory Factor Analysis

Factor analysis was undertaken in order to assess the validity of the scales measuring the variables in this study. The Exploratory Factor Analysis (EFA) was performed on the variables and tests for uni-dimensionality.

When undertaking when performing the EFA on the variables, principal component analysis was specified as the method of extraction. =Factor loadings of greater than 0.4 were considered significant and acceptable. Factors with more than two items loading were considered for further statistical analysis. Items which were crossed loaded were eliminated.

The results obtained from the tests for uni-dimensionality undertaken on the variables are tabled and elaborated upon below.

4.6.1 Attitude towards use of new advanced medical imaging technology (A)

Of the eight items intended to measure Attitude towards use reflected in table 4.6 below, four items were loaded together (A4, A6, A8, and A5) on to the first factor explaining thirty-three-point five percent variance in the data. Factor loadings of between 0.761 and 0.835 were reported for this factor.

The further four items loaded together on the second factor explaining twenty-two-point five percent variance which in total, explained fifty- six percent of the data. Factor 2 loadings of between 0.557 and 0.826 were reported for this factor. The uni-dimentionality was not as expected.

The researcher has identified eight items for the purposes of measuring Attitude Towards Use (A) which he believed was a single factor. For the purpose of this study, the researcher will make use of two factors separately in further analysis.

Table 4.6 EFA loadings of two factor model – Attitude toward Use

Exploratory Factor Analysis (EFA) Loadings (2 Factor model) - Attitude towards use (n=65)

Items	Factor (1)	Factor (2)
A4	0,835	0,015
A6	0,824	0,066
A8	0,789	0,022
A5	0,761	0,004
A1	-0,172	0,826
A2	0,053	0,729
A7	0,258	0,557
A3	0,064	0,521
% of Variance Explained	33,5%	22,5%
% of Total variance Explained	56,0%	

4.6.2 Behavioral Intention to use of new advanced medical imaging technology (BI)

Of the six items intended to measure Behavioral Intention to use (BI) as reflected in table 4.7 below, three items were loaded together (BI3, BI4, and BI2) on to the first factor explaining 30.7% variance in the data. Factor loadings of between 0.727 and 0.824 were reported fort this factor.

The further three items loaded together on the second factor (BI, BI1, and BI5) explaining 25.4% variance which in total, explained 56.1% of the data. Factor 2 loadings of between 0.556 and 0.772 were reported for this factor. Again, the uni-dimentionality was not as expected.

The researcher has identified six items for the purposes of measuring Behavioral Intention to Use (BI) which he believed was a single factor. For the purpose of this study, the researcher will make use of two factors separately in further analysis.

Table 4.7 EFA Loadings of two factor model- Behavioural Intention to Use

Exploratory Factor Analysis (EFA) Loadings (2 Factor model) - Behavioural Intention to use (n=65)

Items	Factor (1)	Factor (2)
BI3	0,824	-0,005
BI4	0,735	0,198
BI2	0,727	0,207
BI6	0,229	0,772
BI1	-0,043	0,735
BI5	0,198	0,556
% of Variance Explained	30,7%	25,4%
% of Total variance Explained	56,1%	

4.6.3 Perceived Ease of use of new advanced medical imaging technology (PEOU)

Of the three items intended to Perceived ease of use (PEOU) as reflected in table 4.8 below, three items were loaded together (PEOU1, PEOU3, and PEOU2) on to the factor explaining 56.1% variance in the data. Factor loadings of between 0.648 and 0.891 were reported fort this factor. These three items which were intended to measure PEOU all loaded as expected.

Table 4.8 EFA Loadings of one factor model – Perceived Ease of Use

Exploratory Factor Analysis (EFA) Loadings (1 Factor model) - Perceived ease of use (n=65)

Items	Factor (1)
PEOU1	0,891
PEOU3	0,663
PEOU2	0,648
% of Variance Explained	55,1%

4.6.4 Perceived usefulness of new advanced medical imaging technology

Of the four items intended to Perceived usefulness (PU) as reflected in table 4.9 below, four items were loaded together (U3, U4, U1 and U2) on to the factor explaining 41.8% variance in the data. Factor loadings of between 0.614 and 0.661 were reported for this factor. These four items which were intended to measure Perceived Usefulness all loaded as expected.

Table 4.9: EFA Loadings one factor model – Perceived Usefulness

Exploratory Factor Analysis (EFA) Loadings (1 Factor model) - Perceived usefulness (n=65)

Items	Factor (1)
U3	0,661
U4	0,657
U1	0,652
U2	0,614
% of Variance Explained	41,8%

4.7 Cronbach's Alpha coefficients for the factors

The Cronbach alpha coefficient is used in order to verify the internal reliability from multiple-item scales. (Collis, J. and Hussey, 2014).

The Cronbach alpha value range is from 0 reflecting no consistency, to a value of 1 reflecting complete consistency as indicated in the works of William G Zikmund, Barry J Babin, Jon C Carr, and Mitch Griffin (2010).

Collis and Hussey, (2014) infer that for a scale to be deemed reliable it would require that the Cronbach alpha coefficient should be greater than or equal to a score of 0.8.

However, William G Zikmund et al., (2010) proposes that scales with a Cronbach alpha coefficient of 0.8 and 0.95 hold significantly good reliability. Furthermore, scales between 0.70 to 0.80 infer good reliability and a value between 0.60 and 0.70 show fair reliability. Lastly, that a Cronbach Alpha coefficient value of 0.60 are indicative of poor reliability.

Table 4.10 Interpretation intervals for Cronbach's Alphas.

Interpretation intervals for Cronbach's alphas:

Excellent	0.80 +
Good	0.70 - 0.79
Fair	0.60 - 0.69
Poor	0.50 - 0.59
Unacceptable	< 0.50

Interpretation for the Cronbach Alpha Coefficients of the factors (Researchers own construct).

Table 4.11 Cronbach's alpha coefficients for the factors

Cronbach's alpha coefficients for the factors (n = 65)

Factor	**Alpha**	Explanation
Attitude towards use Factor 1	0,82	Excellent
Attitude towards use Factor 2	0,30	unacceptable
Behavioural Intention to use Factor 1	0,67	fair
Behavioural Intention to use Factor 2	0,42	unacceptable
Perceived Ease of use	0,51	poor
Perceived Usefulness	0,52	poor

As seen in table 4 11, Attitude toward use Factor 2 and Behavioral Intention to use Factor 2 have been omitted from the study due to both poor and unacceptable Alpha values. The Cronbach alpha values for the variables vary between 0.3 and 0.82.

Two Cronbach alpha coefficients did not meet the minimum Cronbach alpha value of 0.5. Therefore, two of the variables (Attitude toward use Factor 2 and Behavioral Intention to use Factor 2) are omitted and will not be used in further analyses

4.8 Descriptive statistics for factors

In this study, Descriptive statistics is used in order to provide further exploration of the studies' variables pertaining to the survey responses.

Attitude towards use Factor 1 is used as the only variable of Attitude towards use (A). Behavioral Intention to use Factor 1 is also used as the only variable of Behavioral Intention to use (BI).

Table 4.12: Descriptive statistics for the Factors

Descriptive Statistics for the Factors (n=65)

Factors	Mean	Minimum	Maximum	Lower Quartile	Median	Upper Quartile	Std.Dev.
Attitude towards use	4,00	1	5,00	3,50	4	4,50	0,72
Behavioural Intention to use	4,42	3	5,00	4,00	5	5,00	0,54
Perceived Ease of use	4,04	3	5,00	3,50	4	4,50	0,59
Perceived Usefulness	3,91	3	5,00	3,33	4	4,33	0,59

All four of the factors display Mean values which score highly and reflect that the respondents are predominantly in agreement that new advanced medical imaging technology will provide improvements for the operational staff in the imaging services environment.

Table 4.13: Frequency Distributions of the Factors

Frequency Distributions: Factors (n = 65)

Factors		**Negative**	**Neutral**	**Positive**
Attitude towards use	Count	2	6	57
	Percent	3,08	9,23	87,69
Behavioural Intention to use	Count	-	4	61
	Percent	-	6,15	93,85
Perceived Ease of use	Count	-	8	57
	Percent	-	12,31	87,69
Perceived Usefulness	Count	-	18	47
	Percent	-	27,69	72,31

To further confirm the findings expressed in table 4.12. the information provided in table 4.13 of the frequency distribution factors also express that the surveyed respondents (n=65) perceive that future new advanced medical imaging technology may offer significant positive user benefits in the operational environment.

4.9 Correlation between the variables

4.9.1 Pearson correlation

In this study the Pearson Product Moment Correlation has been used in order to represent the empirical fortitude of such relationships between each pair of variables pertaining to TAM. This statistic was selected due to its ease of interpretation. For each pair of the variables s in TAM, PEOU, PU, A and BI were calculated.

Table 4.14: Pearson Product Moment Correlation for the Factors

Pearson Product Moment Correlations for the Factors (n = 65)

Factors	Attitude towards use	Behavioural Intention to use	Perceived Ease of use	Perceived Usefulness
Attitude towards use	-	r=0,2724	r=0,1322	r=0,3839
	-	p=,028	p=0,294	p=0,002
Behavioural Intention to use	r=0,2724	-	r=0,4050	r=0,5075
	p=0,028	-	p=0,001	p=0,000
Perceived Ease of use	r=0,1322	r=0,4050	-	r=0,5347
	p=0,294	p=,001	-	p=0,000
Perceived Usefulness	r=0,3839	r=0,5075	r=0,5347	-
	p=0,002	p=0,000	p=0,000	-

From the table 4.14 it is apparent that the variables are largely significantly and positively correlated ($p < 0.05$) with the exception of Perceived Ease of Use (PEOU) in correlation with Attitude towards use (A).

As discussed by Cohen, (1988) the r-values between 0.2724 and 0.5347 were rereported for the correlations between the variables. The p-values of $p<0.05$ indicates a level of significance of 95% in which the correlations were tested The r-values which measure the strength of the relationship between two variables indicate the level of

correlation, as an r-value of 0 indicates no correlation and an r-value of 1.0 indicates complete correlation

Significant positive associations ($p<0.5$) were reported on the correlations between Attitude (A) and Behavioral Intention to use (BI), Attitude (A) and Perceived Usefulness (PU), Behavioral Intention (BI) and Perceived East of Use (PEOU), and Behavioral Intention and Perceived Usefulness (PU)

Perceived ease of use (PEOU) did not bare an influential correlation to Attitude towards Use (A)

The research Hypotheses findings are as follows:

$H1_0$: Perceived usefulness (PU) does not exert a significant effect on perceived ease of use (PEOU) of new medical imaging technologies. Therefore, the formulated alternative Hypothesis was presented as the following:

$H1_A$: Perceived usefulness (PU) does exert a significant effect of Perceived Ease of Use (PEOU).

According to the statistical analysis it is found that Perceived Usefulness (PU) had a significant relationship to perceived Ease of Use (PEOU), ($r= 0.5347$, $p= 0.000$) as the null hypothesis is not supported, $H1_A$ is accepted as a result of the strong evidence. It is established that Perceived Usefulness (PU) does have a significant effect on perceived ease of Use (PEOU). At a 95% level of significance, this correlation was different than was expected from the usual TAM models found in the literature review. This makes a theoretical contribution to the study.

$H2_0$: Perceived usefulness (PU) has no effect on the behavioural intention to use (BI) new medical imaging technologies. Therefore, the formulated alternative Hypothesis was presented as the following:

$H2_A$: Perceived usefulness (PU) does have a significant effect on behavioural intention to use (BI).

According to statistical analysis, it is evident that Perceived Usefulness (PU) had a significant relationship to Behavioural intention (BI), (r=0.5075, p= 0.000). The alternative Hypothesis is supported and therefore $H2_A$ is accepted as a result of the evidence. It is established that Perceived Use (PU) does have a significant effect on Behavioural intention (BI).

$H3_0$: Perceived ease of use (PEOU) has no effect on Attitude toward use (A) of new advanced medical imaging technologies. Therefore, the formulated alternative Hypothesis was presented as the following:

$H3_A$: (PEOU) does have a significant effect on (A)

According to the statistical analysis, it is found that Perceived ease of use (PEOU) did not influence Attitude toward use (A) (r=0.1322, p=0.294). therefore, the Hypothesis $H3_0$ is accepted because of the evidence and establishes that Perceived ease of Use (PEOU) does not have an effect on Attitude toward use (A).

$H4_0$: Attitude towards use (A) has no effect on Behavioral Intention to use (BI) new advanced medical imaging technologies. Therefore, the formulated alternative hypothesis was presented as the following:

$H4_A$: Attitude towards Use (A) does have a significant effect on Behavioral Intention (BI).

According to the statistical analysis it is found that Attitude towards use (A) did have a significant effect on Behavioral Intention (BI), (r= 0.2724, p= 0.028). Therefore, $H4_A$ is accepted and establishes that (A) does influence (BI) significantly.

4.10 Chapter summary

Throughout this chapter, the empirical results of the study were presented including extrapolations were provided. The results pertaining to the validity and reliability of the measuring instrument were provided. Based upon the Exploratory Factor Analysis, three of the four Hypotheses were proven correct. The variables provided evidence of validity and reliability.

Frequency distribution of the variables indicate that the radiographers in the private sector medical imaging services have a significantly positive perception which reflects a welcoming and engaging attitude towards the adoption and use of future new advanced medical imaging technology and how such technology may assist in the betterment of medical imaging services.

The Pearson's Product moment correlations were presented in Chapter 4. The empirical results will be interpreted, elaborated upon, and managerial implications and recommendations will be provided for the private sector medical imaging services sector of the Eastern Cape. Furthermore, the limitations of this study, conclusions and recommendations for future research will be presented in Chapter 5.

CHAPTER 5 RECOMMENDATIONS AND CONCLUSIONS

5.1 Introduction

In Chapter 4, the empirical findings of this study and the statistics were analyzed and presented.

Chapter 5 will offer an overview of the study highlighting the research objectives, providing a summary of the literature obtained and further elaborating on the research design of this study. The empirical results, interpretation of the results and recommendations will be presented accompanied by the contributions of this study and the study limitations will be addressed in this chapter. Regarding the limitations of this study, suggestions for future research will be presented.

This chapter seeks to present conclusions and recommendations derived from the study and to further provide insight to management. The conclusions will correlate with the recommendations regarding the improving of technology acceptance of new advanced medical imaging technologies.

5.2 Overview of the Study

For the purposes of providing background information of the present study, Chapter 1 presented the problem statement, the motivation for the study and purpose thereof, and the research objectives. The problem statement highlighted issues relating to the introduction, adoption and effective implementation of new advanced medical imaging technology which often leads to employee resistance of such technology. Such resistance often relates to the processes in how management implement and manage introductions of new advanced technology. The motivation for this study is to add to the

existing body of research of technology adoption in the medical imaging services environment in the region of the Eastern Cape of the Republic of South Africa.

This research seeks to assist current and future healthcare management identify various factors than may influence technology acceptance of future advanced medical imaging technologies in their respective medical imaging services businesses. The following will summarize the various objectives of this study and in addition, the research design, adopted methodology of the study and the empirical results will be presented.

5.3 The Research Question and research objectives

The research question of this study was to address what perceptions were held of the operational staff of the private sector medical imaging services which may influence the adoption and implementation of advanced radiography equipment and technology.

In order to address the research question, various research objectives were formulated. The primary research objective is to explore the perceptions of radiographers regarding the implementation of new advanced technology within the medical imaging business practice. Related to the afore mentioned objective, secondary objectives were formed to survey the operational staff members of the medical imaging environment regarding their perceptions and thoughts of new advanced medical imaging technologies. Also, to ascertain whether operational staff believe that advanced imaging technologies may enhance their operational efficiency and lastly, to determine whether operational staff reject of accept future new advanced medical imaging technology.

5.4 Literature review connections

The literature reviews undertaken and written up in Chapters two and three. Chapter two focused on the importance of efficiency improvement, quality improvement, optimization of the business process, enhancements of productivity and performance and further elaborated upon various theories of technology and innovation acceptance

within the context of the healthcare and medical imaging environment. Chapter 2 further elaborated on the Construct of the Technology Acceptance Model and the pertinence towards the use thereof in this study due to its focus on individual users of technology.

Chapter three discusses the concept of research, research design and research paradigm elaborating on the focus of the research and the motivation for which research method was selected for this research study. Further in chapter three, the researcher explains the measurement of constructs, sampling method used for this research and addresses the ethical and logistical considerations required to perform such sampling and data collection.

As previously indicated by the research workings of Ileri and Arik, (2018). Medical science literature has indicated that the introductions of various new advanced medical technologies have often been met with end user resistance. This often relates to various implimentation processes and how management proceeded with the introduction of new technology.

5.5. Value found in the Empirical results

In chapter four, the results were obtained and presented. Evident from the statistical evidence obtained via the survey, it has become apparent that there may well be a need for future considerations to be made by management of medical imaging services to include more junior staff in information sharing sessions regarding future medical imaging technologies.

From the perspective of the operational services staff in the medical imaging sector, Perceived usefulness of new advanced medical imaging technology may be understood to provide improvements towards current operational use. Furthermore, the operational staff reported via statistical analysis that the usefulness of such new technologies are perceived to be easier to use. This may infer that future advanced medical imaging technologies are perceived by end users to offer significant capabilities that are user

friendly. The perceived usefulness of such new medical imaging technologies has been found to offer a significant effect towards the behavioural intention to use new medical imaging technologies by the perspective open end user. this implies that from the perspective of a operational staff end user, it is apparent that such usefulness of new advanced imaging technologies expedite the end users behavioural intention to adopt such future technologies due to operational benefits which may be incurred from the use of such future technologies.

The end users perceptions regarding the perceived ease of use of such new technologies did not bare relevance to the end users attitude toward use of future advance medical imaging technologies. However, established through the TAM it is apparent that perceived ease of use within this study did not have a significant effect on attitude towards use. It may therefore be a consideration for future research in such a context as to what motivations the end users have regarding their perceptions of the ease of use and their attitudes towards new medical imaging technologies.

The attitudes of the medical imaging staff were found to be largely in favor of such new advancements in medical imaging technology. It was statistically obtained in this research that the users of such technology followed the same path as prescribed in the TAM. It may be recommended that future research builds upon this and elaborates on what variables within new technologies in the medical imaging field enhance a positive effect to the perceptions and attitudes of medical imaging service staff members. Such research may further provide insights regarding the determinants of acceptance of such technologies and may therefore cultivate management strategies which are potentially capable of ensuring higher levels of operational staff acceptance towards such technological changes in the medical imaging service industry.

According to the statistical analysis it is found that Attitude towards use (A) did have a significant effect on Behavioral Intention (BI), ($r = .2724$, $p = .028$). Therefore, $H4_A$ is accepted and establishes that (A) does influence (BI) significantly.

5.6 Recommendations derived from the Significance of operational staff engagement

In chapter four, the statistical evidence gathered provided insight regarding the perceptions of advanced medical imaging technologies from the users perspective. The majority of surveyed respondents were found to perceive such new technologies to offer a substantial benefit to the operational environment and consider such technologies to improve the performance levels of the service process. Such positive perceptions may further offer support to the notion that the operational staff are aware of the increasing demand for current medical imaging services and the need in which such services may be required to adapt in order to sustain ethical operational practices which focus on effective and professional patient healthcare standards are met.

5.7 Recommendations derived from the Significance of operational staff adoption towards new technologies

The perceptions of operational staff are shown to hold a significant positive attitude towards new medical imaging technologies which are perceived to offer the medical imaging services environment various benefits which ensure ease of use and usefulness in term of their day-to-day service and operational functions.

Vendors of such new technologies should remain cognizant of such information that it may be considered a barrier to entry in the market should end users perceive new advanced imaging technologies to be less user friendly than current technologies.

Furthermore, it may be a consideration for medical imaging services management and / or vendors/ manufacturers of such new technologies to ensure that operational staff currently working in medical imaging provide sufficient training and demonstrations of new technologies and emphasize the manner in which such advanced technologies may be able to improve on current operational standards.

5.8 Recommendations for management

Managers of medical imaging practises should consider developing initiatives in which employees and operational staff involved in medical imaging practises are able to access and be exposed to future advanced medical imaging technologies in order to gather insight of the perceptions of such technologies from an end user perspective and to further gain information regarding the attitude's and intentions such operational staff members regarding the eagerness or hesitancies towards such technologies. such information may be pertinent for future planning purposes regarding new established operational services or current process improvement where such new technologies may offer the desired operational and process improvements.

5.9 Limitations

The limitations of this study were in the context of a private sector medical imaging practice operating within the region of the Eastern Cape of the Republic of South Africa

Furthermore, this study focused primarily on original construct of the technology acceptance model and excluded various derivatives and adaptations. The researcher also acknowledges the limitations of the protocols in place at the time of this study and the impact that Covid-19 had on the medical imaging services sector including limited access to survey participants and a large nonresponsive survey population. It was for this reason that the study focused purely on a quantitative approach and referred specifically to the context of new medical imaging technologies.

Future research may enjoy the benefits of deeper statistical analysis and the use of open-ended questions which may provide significantly deeper insights on the matter of acceptance or rejection of future technologies intended for the betterment of the diagnostic imaging services sector.

5.10 Contributions of the study

This study has made various contributions. The scales utilised to measure the technology acceptance model within the context of the perceptions of medical imaging operational staff where is sourced from existing research studies. two of the items did not load onto a single factor. By validating the variables of technology acceptance in the context of the end users perception of knew medical imaging technologies. this study has made a positive contribution towards the paucity a research of technology acceptance within the healthcare services industry.

Based on the empirical findings, The identified variables were found to influence the acceptance of new medical imaging technology in the medical imaging services environment. as a result of these findings, several recommendations have been elaborated upon in an attempt to assist stakeholders within the medical imaging services sector with a desired level of information and insight regarding the perceptions of the end users currently working in medical imaging services. Such information may assist future healthcare management in policy making processes which ensure that various levels of staff members and external identified staff are considered with regards to various technological introductions.

Vendors may further benefit from such engagements in order to cultivate improved levels of adoption or, failing which, insights regarding the issues raised on the topic of the adoption or hesitancy of use of their proposed new technologies in the medical imaging environment.

In addition, the findings of this study may further assist healthcare management and organisations by providing insight into the perceptions of their operational staff with regards to the adoption and implementation process when planning future change management initiatives and new technology implementation processes.

5.11 Future research recommendations

It is recommended that future research attempts to consider such future operational practices within a broader context. The limitations of this research were focused directly on a single private sector medical imaging department operating in the Eastern Cape. Future research may be required in the public sector which currently is the single largest healthcare services provider in the Republic of South Africa focusing on ensuring healthcare is available to all stakeholders within large cities and rural regions within the region. Such future research may provide greater statistical information for current and future decisionmakers in order to align current operational strategies and service efforts to meet the demands of the growing medical imaging services of the future.

5.12 Self-Reflection by the researcher

The presented study has allowed the researcher to develop a great understanding and deeper insights of be current perceptions of new medical imaging technologies held by the current operational stop within the private medical imaging services sector. The researcher has also sharpened specific skills such as writing, data analysis and the interpretation of the empirical results, understanding the difference is in points of view and above all else, the principles of effective communication.

5.13 Conclusion

From the research conducted, comprehensive information, knowledge and greater insights have been gained with regard to the role of the technology acceptance model as well as the perceptions which affect adoption or rejection of new medical imaging technologies from the perspectives of medical imaging service providers. medical imaging organisations play a vital role within the healthcare services sector. operational staff members who are engaged, informed and Open to change Play a significant role in the adoption of technology and the future benefits that such technological advancements offer both in terms of their operational requirements and within the context of the betterment of the healthcare services sector.

APPENDICES

APPENDIX 1

TAM Questionnaire

Questionnaire

1	I hereby wish to take part of the survey and I am aware that I have the right to opt out of this survey at any point.	Opt out survey		Continue Survey		
	Please Answer Questions 2-5 by clicking on the correct box.					
	Questions					
2	In which age group will you be on 31 December 2022?	20-30	31-40	41-50	51-60	60+
3	Where do you currently perform the bulk of your work in terms of location?	PE	GT	UIT	J-Bay	Hum
4	Please indicate the number of years you have served as a radiographer.	0-5	6-10	11-15	16-20	20+
5	How many years have passed since your Graduation?	0-5	6-10	11-15	16-20	20+
	Please indicate the extent to which you disagree/ agree that the following statements prevail in your firm: Indicate by clicking 1 - Strongly disagree / 2 - Disagree / 3 - Neutral / 4 – Agree / 5 – Strongly Agree.					
		Strongly disagree	1 2 3 4 5		Strongly agree	
6	**Behavioural intention to Use (BI) 1** I am able to learn the operation of the new technologies with your work environment with ease.	1	2	3	4	5

7	**Perceived usefulness (PU) 1** I think the deep learning advancements within medical imaging improve image quality.	1	2	3	4	5
8	**Attitude toward use (A) 1** I think that the new technologies in the medical imaging environment will be easy to learn.	1	2	3	4	5
9	**Perceived ease of use (E) 1** I find it easy to adapt to using new technologies within the medical imaging environment.	1	2	3	4	5
10	**Attitude toward use (A) 2** I think I may require assistance on new technologies implemented in the imaging environment.	1	2	3	4	5
11	**Perceived ease of use (E) 2** I think I will require ongoing training on the new technologies implemented in the imaging environment.	1	2	3	4	5
12	**Attitude toward use (A) 3** I feel that I may enjoy the	1	2	3	4	5

	improvements in my day to day work environment due to the new technologies of future medical imaging equipment.					
13	**Behavioural intention to Use (BI) 2** I believe that new technologies within the work environment will greatly assist me in performing my duties optimally.	1	2	3	4	5
14	**Behavioural intention to Use (BI) 3** I work better with new technologies currently implemented in the work environment.	1	2	3	4	5
15	**Behavioural intention to Use (BI) 4** I feel that I will become more proficient in my operational requirements with the new technologies of the future medical imaging equipment.	1	2	3	4	5
16	Perceived usefulness (PU) 2 I think it will be easy to learn how the new technologies operate.	1	2	3	4	5
17	Perceived usefulness (PU) 3 I feel that the new technologies in future will improve the work environment of radiography.	1	2	3	4	5

18	**Attitude toward use (A) 4** I think that as a radiographer, I will be confident with my ability to produce an improved level of service with the implementation of new medical imaging technologies of the future medical imaging equipment.	1	2	3	4	5
19	Perceived usefulness (PU) 4 I feel that the vendors of new technologies implemented within my environment are easily contactable.	1	2	3	4	5
20	Attitude towards use I think that the vendors are highly skilled and proficient in their ability to assist and provide technical solutions in the imaging environment?	1	2	3	4	5
21	Attitude towards use I feel that the vendors are providing my imaging facility with the best technologies available in the market.	1	2	3	4	5
22	Attitude towards use I expect that the new technologies in the medical imaging field may improve the quality of service.	1	2	3	4	5
23	Attitude towards use I am confident in the vendors ability to deliver a professional service.	1	2	3	4	5

24	Attitude towards use I am satisfied with the experience of using new technologies within the imaging environment.	1	2	3	4	5
25	Attitude towards use I will continue to use the new technologies implemented within the work environment.	1	2	3	4	5
26	Attitude towards use I will continue to make use of the vendors who support such new technologies?	1	2	3	4	5
Thank you for participating in this survey. The survey has ended.						

NELSON MANDELA
UNIVERSITY

Appendix 2

Bay Radiology
36 Newton Street
Newton Park
Port Elizabeth
Eastern Cape
6045 RSA

Dear Sir/ Madam

SEEKING INSTITUTIONAL PERMISSION

I am currently a student at the Nelson Mandela University Business School studying towards my MBA (Master of Business Administration) degree. I wish to conduct research on the Technology Acceptance Model regarding the perceptions of the operational staff on the implementation of advanced radiography equipment. My aim is that my study will contribute towards the current body of literature of technology acceptance and further provide insight regarding the intricacies and challenges of technology adoption within the medical imaging business environment.

With your permission the study may be conducted by a self-administered electronic questionnaire distributed to the radiographers within your practices. The questionnaire is attached for your perusal. Please note that participants have full anonymity and may opt out of the survey at any point if they wish to do so.

The data collected from the survey will be statistically analysed and tested.

My supervisor is Dr Jessica Fraser of the Nelson Mandela University Business School. Her details are as follows:

Tell: 0861-504 500

Email: Jessica.Fraser@mandela.ac.za

The information and findings of this study will be shared with your office.

Kindly let me know if you will be so kind as to grant me permission for the study to be conducted.

I thank you in advance.

Regards

Bryan James
082 062 2473
S223535109@mandela.ac.za

NELSON MANDELA
UNIVERSITY

Appendix 3

Written information given to Human subject on recruitment

• PO Box 77000 • Nelson Mandela University
• Port Elizabeth • 6031 • South Africa • www.mandela

Dear Respondent

I am studying towards my MBA (Master of Business Administration) degree at the Nelson Mandela University Business School. I am conducting research on the perceptions of new technology within the medical imaging environment. I believe that my study will make an important contribution to improved performance of these businesses.

You are part of our selected sample of respondents whose views we seek on the above-mentioned matter. We would therefore appreciate it if you would allow me the opportunity to assist with the distribution of an electronic survey questionnaire regarding the staff's perceptions of such new technologies in the medical imaging environment. It should not take more than ten minutes of your time and we want to thank you in advance for your co-operation. There are no correct or incorrect answers. Please answer the questions as accurately as possible. For each statement, tick the number which best describes your experience or perception.

There will be basic quantitative questions regarding age, Location, Education level, years since graduation and years served as a radiographer. Other Yes/No questions

would involve the participants knowledge of the future of new technology within the medical imaging environment

The Likert style questions for example would be, if you strongly agree with the statement, tick the number 5. If you strongly disagree with the statement kindly select the number 1 and if you agree, select the number 5. **Tick only one answer for each statement and answer all questions please.** Please note also that your participation in this study is entirely voluntary and that you have the right to withdraw from the study at any stage. We also guarantee your anonymity and the confidentiality of information acquired by this questionnaire. Neither your name nor the name of your firm will be mentioned in the study.

Thank you very much.

Mr. Bryan James

Contact details: S223535109@mandela.ac.za Cell: 082 0622473

To verify the authenticity of the study, please contact Dr. Jessica Fraser 0861-504 500 and Jessica.Fraser@mandela.ac.za

APPENDIX 4

Dear Sir/ Madam

SEEKING INSTITUTIONAL PERMISSION

I am currently a student at the Nelson Mandela University Business School studying towards my MBA (Master of Business Administration) degree. I wish to conduct research on the Technology Acceptance Model regarding the perceptions of the operational staff on the implementation of advanced radiography equipment. My aim is that my study will contribute towards the current body of literature of technology acceptance and further provide insight regarding the intricacies and challenges of technology adoption within the medical imaging business environment. The survey will take approximately 5 to10 minutes.

With your permission the study may be conducted by a self-administered electronic questionnaire distributed to the radiographers within your practices. The questionnaire is attached for your perusal. Please note that participants have full anonymity and may opt out of the survey at any point if they wish to do so.

The data collected from the survey will be statistically analysed and tested.

My supervisor is Dr J.Fraser of the Nelson Mandela University Business School. Her details are as follows:

Tell: 0861-504 500

Email:

The information and findings of this study will be shared with your office.

Kindly let me know if you will be so kind as to grant me permission for the study to be conducted.

I thank you in advance.

Regards

Bryan James
082 062 2473
S223535109@mandela.ac.za

Appendix 12:

Written information given to Human subject on recruitment

Dear Respondent

I am studying towards my MBA (Master of Business Administration) degree at the Nelson Mandela University Business School. I am conducting research on the perceptions of new technology within the medical imaging environment. I believe that my study will make an important contribution to improved performance of these businesses.

You are part of our selected sample of respondents whose views we seek on the above-mentioned matter. We would therefore appreciate it if you would allow me the opportunity to assist with the distribution of an electronic survey questionnaire regarding the staff's perceptions of such new technologies in the medical imaging environment. It should not take more than ten minutes of your time and we want to thank you in advance for your co-operation. There are no correct or incorrect answers. Please answer the questions as accurately as possible. For each statement, tick the number which best describes your experience or perception.

There will be basic quantitative questions regarding age, Location, Education level, years since graduation and years served as a radiographer. Other Yes/No questions would involve the participants knowledge of the future of new technology within the medical imaging environment

The Likert style questions for example would be, if you strongly agree with the statement, tick the number 5. If you strongly disagree with the statement kindly select

the number 1 and if you agree, select the number 5. **Tick only one answer for each statement and answer all questions please.** Please note also that your participation in this study is entirely voluntary and that you have the right to withdraw from the study at any stage. We also guarantee your anonymity and the confidentiality of information acquired by this questionnaire. Neither your name nor the name of your firm will be mentioned in the study.

Thank you very much.

Mr. Bryan James

Contact details: S223535109@mandela.ac.za Cell: 082 0622473

To verify the authenticity of the study, please contact Dr. J.Fraser 0861-504 500 and JFraser@mandela.ac.za

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