Factors that influence technology acceptance in National Health Service Hospitals

A Technology Acceptance Model study

A thesis submitted in accordance with the requirements of the University of Liverpool for the degree of Doctor of Business Administration

By

Jason Bincalar

November 2020

ABSTRACT

This thesis examines the factors that impact technology acceptance in NHS hospitals. By carefully applying scholarly methods, actionable knowledge is created and immediately used to improve current practice and benefit healthcare. The research expands the existing body of knowledge by creating a reliable way of measuring technology acceptance and exposing the factors that influence technology acceptance in NHS hospitals.

The NHS is a large public sector organisation, which uses the New Public Management ethos to achieve value for money and efficiency. The NHS invests heavily in clinical innovation alongside Information Technology (IT) innovation, with the goal of increasing productivity while driving down costs. Such investments include systems, software and networks, which have been borne out of the Connecting for Health Shared Service Centre and the National Programme for IT. In real terms, such innovation enables more patients to be treated every 24 hours. Over the past twenty years, many high-profile NHS IT projects have featured on national television and in the press. In most cases, its failure that is communicated, typically due to lengthy delays, the lack of use and uncontrollable costs. In some cases, the technology initiative is abandoned, frustrating patients and staff. While practising in this field, it is evident that lessons are not learned. Technology projects are often assessed using a single dimension, which is cost. What may be more appropriate is assessing the benefits from adopting the system. This research re-addresses the knowledge gap by using Action Research (AR) to identify and target actions, which centres on improving the acceptance of a multi-million-pound technology investment in hospital electronic document management (EDM). The technology replaces the paper-based patient medical record, which has been used for over seventy years. As part of the observing and reflecting stages, the Technology Acceptance Model (TAM) created by Davis (1989) was used to measure the factors that impact technology acceptance of EDM. End-users were surveyed and stakeholders interviewed to expose the most significant factors, which included perceived usefulness, training and resources amongst others. All factors are represented in a conceptual model as constructs and tested by applying commonly accepted methods.

While this thesis represents an extended TAM study, it differs significantly from traditional TAM studies which follow a positivist approach and a heavy reliance on quantitative methods. In this case, a hybrid approach is utilised, blending quantitative research with qualitative research. The benefit is that this approach revealed the context to the quantitative results, providing an in-depth understanding of the problem and explanation of the results. Continuing the AR cycle led to the planning and acting stages, whereby improvements were implemented to training, computer availability and system performance, benefiting practice.

For reasons that remain unexplained, there is limited literature relating to technology acceptance in NHS hospitals. Many literature searches took place, using reputed sources, including the University of Liverpool online library and Google Scholar, which exposed a significant gap in knowledge. As such, this research represents a unique contribution that positively expands the theory relating to technology acceptance in NHS hospitals.

DEDICATION

I dedicate this thesis and all of my work to my father, Michael Bincalar. My DBA journey commenced several years ago, with my father by my side. Dad has always been my lead supporter, coaching, providing encouragement and inspiring me. Dad's involvement was appreciated, especially when times were tough. During 2015, after several unexpected incidents, Dad was diagnosed with a rapid onset of dementia, and our outlook on the world changed. While we are still on this journey together, it is my turn to provide support and encouragement. The completion of this thesis is my most significant achievement and something that I can give back to Dad, which I know that he will appreciate.

DECLARATION

I confirm that I have read and understood the University's Academic Integrity Policy.

I confirm that I will act honestly, ethically and professionally in conduct leading to the collection of data for research and the submission of assignments, papers and other assessed work for the programme of study.

I confirm that I will not copy material from another source nor collude with any other student in the preparation and production of work for assessment, nor commit plagiarism, nor fabricate data when completing work for assessment.

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LIST OF ABBREVIATIONS

AI	Artificial Intelligence
AFC	Agenda for Change
ALS	Action Learning Set
AR	Action Research
AVE	Average Variance Extracted
CFH	Connecting For Health
CMV	Common Method Variance
EDM	Electronic Document Management
EMR	Electronic Medical Record
EU	European Union
EPR	Electronic Patient Record
ERP	Enterprise Resources Planning
GP	General Practitioner
IG	Information Governance
IS	Information System
ISSM	Information Systems Success Model
IT	Information Technology
NHS	National Health Service
NPM	New Public Management
NPFIT	National Programme for IT
ML	Machine Learning
QR	Quick Reference
RAG	Research Advisory Group
SD	Standard Deviation
SEM	Structural Equation Modelling
TAM	Technology Acceptance Model
TPB	Theory of Planned Behaviour
TRA	Theory of Reasoned Action
TTF	Task-Technology FIT
UK	United Kingdom
USA	United States of America

CHAPTER 1 INTRODUCTION

1.1 Chapter introduction

Chapter 1 sets out the objectives of the research and provides the organisational context. The technological journey that the National Health Service (NHS) has embarked on is explained along with the reasoning behind it. The research establishes the desire for the NHS to have a sustainable future by implementing technology innovation (Jansen 1994). Technology, in this instance, is used to strengthen the connection between healthcare providers and patients by freeing up precious resources, such as doctors and nurses (Davis 2011).

1.2 Research Context

The thesis charts my learning journey, demonstrating my commitment to put in to practice all that I have learned from the DBA programme. By applying the knowledge gained from the DBA, I demonstrate the ability to think critically, to create actionable knowledge and how I can apply the scholarly practice to workplace problems. Such knowledge benefits my practice as I now routinely apply these techniques, which have led to taking alternative approaches and providing better outcomes. One such example is insisting that end-users complete mandatory systems training before receiving their system login, which also improves the user experience (Yaverbaum and Nosek 1992). The improved approach avoids staff picking-up bad practice from colleagues while learning on the job, leading to better technology acceptance. My abilities now extend to being able to seek and apply established theory relating to technology acceptance, and much of this research builds on accepted methods that stem from systems theory. Systems theory focuses on the complex relationships between parts (Buckley 1967). As with all systems, there is a need to apply a holistic approach to every part (Bertalanffy 1968). Part of my critical thinking has led me to understand everything that is involved with using a system successfully before implementing a new system. By developing powers of enquiry, persistence and learning, this thesis demonstrates my transformation from being a committed worker to being a scholarly practitioner, applying scholarly methods to improve practical wisdom (Bardach 1987).

1.2.1 Pressures on the NHS

The NHS is responsible for addressing the healthcare needs of UK residents. Since its creation by the Labour government in 1948, the NHS is entirely free to use at the point of care (O'Dowd 2012). Under this arrangement, a patient does not typically pay for the care they receive. Remarkably, the NHS is one few places in the world where a patient can receive a quality service and not have to pay (Schneider et al. 2017). The NHS never refuses emergency care, which, along with care for the elderly who have a higher proportion of chronic illness (Shrivastava et al. 2013), places a significant demand on the service. As such, the demand is high, and many of the NHS operating entities, including hospitals and health centres now routinely fail to deliver against nationally set targets (Boseley 2015).

The demand on the NHS stems from three key factors, longer life expectancy, increased births and population expansion through immigration (Angus and Shiroyama 1995). None of these factors is directly controllable by the NHS. Over the past thirty-five years, the life expectancy of males has risen from 70.8 years to 79.3 years and females from 76.8 to 82.9 years (Morgan 2019). There is a crucial assertion that there will be a staggering increase of 25% for those that require care between 2015 and 2025, which will have a significant cost implication (Boseley 2017). A simple observation is that while the population is increasing, the NHS has not been growing at the same pace, with limited funding, which is not likely to improve (Hazzell 2016). There have also been a large number of hospital closures and mergers, so in real terms, the resources available to the NHS are decreasing (Lacobucci 2014). Increases to the population, especially with immigration and health tourism have been a significant concern in the UK (Hanefeld et al. 2013), as such increases directly influence the demand for public services (Getzen 1992). The population has been growing each year (Cangiano 2016), but may slow from 2019, as the UK exits the European Union (EU), which has positive and negative consequences (Coleman and Rowthorn 2011). A key argument leading to the exit from the EU stems from the freedom of movement for EU citizens (Glencross 2016), which places a significant demand on the NHS (Newdick 2006). The independent watchdog for health estimates that the NHS spends £2 Billion of its £130 Billion

budget providing healthcare for immigrants, which the NHS is unlikely to recover (King's Fund 2015). While the NHS has no direct influence on the demand placed on it (Pencheon 1998), many see that there are improvements that the NHS can make (Lemur et al. 2012). Such improvements are expected to help the NHS cope better while maintaining standards. One such improvement is a reorganisation, and rather than being a standard government department, the NHS benefits from New Public Management (NPM), with a strong focus on financial control, value for money and efficiency (Hood 1991). The standards of care and existing service level provided by the NHS is made transparent by a government-enforced reporting regime, which is typical for NPM (Jackson and Hood 1991). Reports are published monthly and indicate actual performance against the national targets. While the NHS publishes many performance indicators, it is indicators such as waiting times and mortality rates that have the most meaning for the public (Marshall et al. 2000).

The NHS is known to deliver world-class care, and the majority of citizens value not having to pay for care. The downside to free care is that waiting times can be considerable (Silvester et al. 2004). By way of example, a relative waited over a year for routine dental surgery. If they went private, this would have been conducted within two weeks. There is an expectation that all areas of the health service must be improved. At the same time, the operating costs must remain the same. Many NHS staff and members of the public posit that more staff are required to improve the service, with the Royal College of Nursing revealing that the service is short by 20,000 nurses (Triggle 2013b). Such claims are worthy of further study, including alternate ways to improve the service. One such improvement with the potential to reduce cost is using Information Technology (IT) more comprehensively, such as to reduce medication errors (Bates 2000).

1.2.2 The need to improve IT implementation and adoption

The robust use of technology can bring many benefits, such as safety, speed, and performance (Bates and Gawande 2003). Technology also has the potential to ease the burden on existing staff. Using technology provides an opportunity for patients to be registered and diagnosed quicker, self-service and the matching of unused capacity with demand. Technology when used appropriately, can significantly reduce cost, as asserted by Price Waterhouse and Coopers, a leading firm of auditors and management consultants who posit that £4.4bn could be reinvested in the NHS by better use of IT (Triggle 2013c). Such an approach is also supported by researchers, who assert that healthcare computer systems offer economic benefits, as they help to identify potential bottlenecks in the provision and administration of a patient's care (Johnson 2009). Naturally, there would need to be a willingness among staff to use this information and integrate it into a continual improvement programme.

There are now many IT solutions available to the healthcare industry, which can be used to underpin and streamline the vast majority of administrative and clinical functions (Littlejohns et al. 2003). The array of IT systems includes systems for patient registration, appointment scheduling, diagnostic reporting, clinical noting, prescribing and outcome recording (i.e. discharge summaries). While such IT systems are in widespread use across healthcare, the benefits to the NHS, its staff and patients are not easy to measure (Blaya et al. 2010) and cannot solely be derived from the existence of such systems (Heathfield et al. 1998). From experience, I belive that there must also be widespread technology acceptance to derive benefit, as asserted by Free (2004). Significant levels of user acceptance will deliver tangible and measurable benefits back to healthcare (Tsu and Shane 2004). As such, the focus of this research is end-user technology acceptance in NHS hospitals.

1.2.3 My professional role

Reflecting on my professional role, I am an IT leader who directs sizeable digital transformation programmes. I believe that I am incredibly privileged as I work across a wide range of hospitals, clinical and non-clinical departments, uniting hospital functions and gaining a holistic view of the NHS. In my practice, an essential task is to document the before and after business processes, learning the “as-is” state and designing the “to-be” future state. A career-long passion is using the Lean methodology for process improvement and the reduction of wasteful processes and steps. Lean is a methodology used to add more value to customers by removing waste, as asserted by Holweg (2007). Lean is well-used methodology within healthcare settings (Jones and Mitchell 2006) and can be combined with the plan, act, observe principles of Action Research (AR) as asserted by Kimsey (2010). Across the hospitals, I have observed that most staff have learned to master a specific business process. For example, end-users have become proficient in how to receive and accept or reject a care referral. A referral is a request from another doctor to see a patient. Often while staff make changes to their processes to make them more efficient, they fail to acknowledge that other processes take place before and after their process, there is too much information for them to process (Lee and Dale 1998). Such changes lead to the discovery of other process issues within the NHS. Sometimes additional bottlenecks are inadvertently caused while attempting to remove existing bottlenecks (Netjes et al. 2009). To make a successful change, a holistic approach must be taken, which would require stakeholders to engage across the length and breadth of the NHS. In such instances, being one of the few people trusted to make such change happen is a privileged and rewarding position.

1.2.4 Genesis of NHS IT

The NHS is the third-largest employer in the world (Long & Griffiths 2013) and is a public sector body as it is primarily funded by the UK government. Secondary funding comes from performing privately funded health procedures, a growing NHS function (Propper 2000), which competes directly with the private sector (Morga and Xavier 2001). There are many similarities with the public and private sectors (Boyne 2008; Lachman 1985; James and Hal 1988; Baldwin 1987), however, differences, do not stem from technology acceptance as both rely heavily on information systems for productivity (Lorin and Brynjolfsson 1996) but from organisational culture (Moon 2000; Collins 2008). A third funding source is from charitable donations. The NHS went through a significant reform in 1990 (Ferlie 1995), whereby there was a clear departure from the central government by applying the principles of NPM.

1.2.4.1 New Public Management

NPM is a concept that dates back to the early 1980s and is a reform for the public sector, which introduced market mechanisms that were adopted in the UK (Hood 1991). The concept was to operate public sector organisations like private sector organisations because private sector organisations were thought of as being superior (Muzzcato 2013; Murray 1975). The reasoning was that private sector organisations were self-sufficient and cost-effective (Domberger and Jensen 1997). The purpose of NPM is to make the public sector more commercial (Stark 2002), with a vertical management structure and accountability leading to better performance (Laegreid 2015). With the NPM public sector bodies started to implement decentralised, local management structures, providing autonomy and accountability (McLaughlin et al. 2002). The NHS now closely follows NPM (Carter 2000), with management structures and practice of the being directly comparable with private sector organisations, whereby the focus is on output and outcomes (Fatemi and Behmanesh 2012). Public services can also benefit from automating high volume activities. An excellent example of high-volume activity within healthcare is prescribing and medicines administration. The vast majority of patients receive a prescription which needs processing by a pharmacy, and

the focus must be on maximising effectiveness while minimising risks and costs (Lexchin 1998).

With the advent of modern management practice and the belief that being competitive, innovative and dynamic comes from more market and less state control (Mazzucato 2013), the NHS operating environment went through a significant change. Before NPM, the hospital was run by leading clinical staff (Edwards et al. 2003). The focus was on delivering care with minimal regard for cost and sustainability. Over time, the cost of providing free care became unsustainable, a situation that became the catalyst for a change in management practice. With improvements in public service, particular attention is given to using management information (Goddard et al. 1999) to determine the best cause of action. Granular management structures were also implemented to oversee clinical activities. By adding administrative layers, there was a shift from being a clinical body to being a service provider backed by business processes. Technology solutions now underpin the vital functions of the service, such as appointment booking and theatre schedules. Management information for the NHS is now available on a routine basis and can be used to target improvements, just like with profit-making organisations.

1.2.4.2 Shared Service Centres

NPM brings with it many new approaches, such as centralising resources into Shared Service Centres (SSC) (Schwarz 2014, Pallott, 1999). SSC's have been the comprehensive delivery arm for technology innovation in the NHS. While there is no universally accepted definition for SSC (Schulz and Brenner 2010), the term implies a pooling of similar resources, to consolidate process and support resources, with the common goal of, collaboration, cost reduction and improving efficiency (Janssen and Joha 2006; Schwarz 2014; Hashem et al. 2017; Becker et al. 2009; Tammel 2017). As such, SSCs exist in the public and private sectors (Wang and Wang 2007), with technology services being one of the most common examples (Schulz et al. 2009). In the majority of cases, all public sector SSC's leverage technology to provide efficient services (Bergeron 2003). Other examples of SCC's include Human Resources (Reilly and Williams 2003) and Procurement. SSC's are common in the NHS and extend beyond IT

to catering, legal and estate maintenance. The ambulance service also operates an SSC. The benefits are achievable through careful planning (McIver et al. 2011), standardisation (Howcroft and Richardson 2017) and building strong relationships with suppliers and stakeholders (Borman 2010; Jia et al. 2015). Strong governance regimes are also essential (Grant et al. 2007; Wagenaar 2006; Burns and Yeaton 2008), which is irrespective of country and the industry that implements the SSC (Soalheira and Trimbell 2014).

Using technology to benefit the NHS is not a new initiative and has been high on the government agenda since 1997 and a matter of government policy since 1999 (Brown 2001). In keeping with its election manifesto, in 1997, the Labour party commenced its plan to modernise the NHS (Watson 2001). To ensure delivery on this promise and to control technology spend, the Labour government established the national technology SSC, branded Connecting for Health (CFH). Established in 2000, its mission was to introduce a complex range of integrated IT systems and services that would streamline patient registration, appointments, diagnostics, care planning and discharge processes. In the USA, the US government incentivises private companies to implement health IT solutions, which helps reduce the responsibility for central government (Jones et al. 2014).

Having investigated the failings of historic NHS IT projects, the Public Accounts Committee concluded that without stakeholder understanding of the business case, the risk of failure is high, and so the learning from this led to the creation of the NHS National Programme for IT (NPFIT), which was managed by CFH to bring together specialist knowledge and focus (Brown 2001). With the creation of a technology SSC, the government focused its technology expenditure by centrally delivering initiatives and standardising technology solutions nationally. Such an approach would harmonise the patient experience and ensure that staff could easily transition between different healthcare providers (Hendy et al. 2005). A key objective of CFH was to deliver an electronic system that provides every patient in the UK with an electronic record that would be accessible by relevant staff whenever and wherever care was required (Greenhalgh et al. 2013). The electronic patient record would replace the paper-based records currently distributed across GP practices, clinics and hospitals. It is not easy to share paper-based records, as asserted by Booth (2003). The intention was to

make all patient information available to clinical staff so that clinicians could make informed decisions. The patient record may also contain information that is vital to patient safety, such as allergies, reactions, diagnosis and medications. Not having sight of such information could have dire consequences for the patient (Black et al. 2011). The patient record grows over time and also includes diagnostic results, appointment letters, diagnosis and episodic information. Nearly twenty years on and paper is still in widescale use, with significant barriers to sharing information (Booth 2003). Despite this, CFH managed to introduce new systems in some hospitals, GP practices and community care centres. The notion of making the patient record electronic and making the electronic record available to all healthcare providers on an as-needed basis was abandoned as it was a costly pursuit. The major stumbling block was reaching consensus on the format of the electronic patient record and the colossal amount of patient history to digitise and store. Furthermore, clinicians found it difficult to agree on how a system to review and update the patient record would function and what features would be available. By 2008, there was a realisation that providing a fully electronic patient record would not be possible and so instead, a Summary Care Record (SCR) was launched nationally. The SCR contains the patient's medications, reactions, and allergies. These three items were deemed to be the most vital information. As fate may have it, I was fortunate to have served with the national clinical lead for SCR and gained valuable insight into the decisions relating to the solution and its content. The next big challenge for CFH to overcome were the barriers to sharing information. As the patient systems were designed to share data, the requirement to restrict access to patient records amongst the user community rocked the programme. CFH became deeply embroiled in the need to ensure patient confidentiality, patient consent and the world of Information Governance (IG), as asserted by Becker (2007). All of which limited technology acceptance within the NHS. IG concerns itself with ensuring that patient information kept is confidential and only accessed by those with a legitimate need (Becker 2007). As part of the IG requirements, a log entry is made indicating the person who accessed the patient record along with the date and time stamp. The logs are auditable, and regular audits are encouraged. A full audit trail is a tangible benefit of an electronic system, as with paper-based records, there is no way of knowing who has read the patient record as the log typically states just who requested the record. As part of the IG

principles, patients can view their record by request and also opt-out of having an electronic record (Powell et al. 2006). A combination of GP's opting their practice out, Primary Care Trusts (the budget holder) opting out and patients opting out meant that the SCR was not available for all patients and was limited to specific geographies across England. As such, only 1 in 3 people have an SCR entry, which is disappointing (Davies 2013). Despite the setbacks, the NHS is still pursuing electronic patient records and has committed to going entirely digital and being paper-free by 2020 (Dunhill 2015). As part of this approach, the NHS is rapidly implementing Electronic Document Management (EDM) systems and document scanning services to transform paper into electronic records. There have also been some technological successes that are noteworthy, with Johnson (2009) defining the accomplishments as being a secure email platform with 170,000 users, a national network linking 15,000 sites and numerous patient administration and imaging systems. Through my practice, I have been directly involved in delivering these solutions and agree with the benefits, which I have witnessed first-hand, including the immediate transfer of diagnostic images from one hospital to another while a critically ill patient is transferred between them. I have learned much through delivering such initiatives, which was fraught with technical and political challenges. The value of the programme was stated as being £12.6 Billion and delivered through a small number of large corporations as nationally appointed suppliers. A single product and a single supplier approach were avoided, as the government wanted to ensure competition and choice. Appointing multiple suppliers reduced the risk of a single supplier going bust and encouraged value for money through competitive pricing (Stole 2007). The influences of NPM and the use of market forces to achieve the best value were made clear (Martin et al. 2001).

While most of these IT systems and services are still in use today, many of the published accounts depict NPFIT as being a colossal failure, which has resulted in the large-scale abandonment of technology. Ewushi-Mensah and Przasnyski (1994) assert that it is the lack involvement of end-users, the lack of commitment from senior management and the lack of critical expertise that leads to the abandonment of IT projects. I tend to agree as these themes echo throughout the literature, including Browns et al. (1999) who after studying NHS IT projects asserts that end-users must be involved as much as possible. Ewushi-Mensah

and Przasnyski (1994) also assert that abandoning such technology projects should not be perceived as being negative, as such a decision will lead to less wasted resources, avoiding throwing good money after bad. Abandoned projects should also lead to the recording of valuable lessons learned that future IT projects could use, with a compelling need for IT project managers to use a systematic approach to using such lessons (Duffield and Whitty 2015). Such a realisation is another area where my practice has changed, and I have recently recommended that a project be abandoned instead of continuing with reduced benefit. Learning lessons and changing practice is not a new approach for industry. Owing to failures leading to death, the aviation and space exploration industries have implemented stringent knowledge management processes (Olla and Holm 2006). These industries ensure that root cause analysis takes place for all failures and the lessons recorded. The lessons learned forms the basis of not making similar mistakes in modern practice and future innovations. Much can be learned by following such practice, and the learning leads to far less waste (Williams 2008). The NHS also has a responsibility for life and has put in place robust processes for clinical practice, such that it too can avoid the same adverse events in the future (Barach and Small 2000). There is literature to support the fact that the NHS is a learning organisation, however, outside of clinical practice, not much could be found in this area. In practice, it is often left to managers to determine if there are valuable lessons to learn from previous projects (Peterson and Kim 2000). There is a compelling need to review the “de-railers”, the potential issues that cause the train to leave the tracks and benefit from valuable lessons when delivering NHS technology projects (Doherty et al. 1998). Through my practice, I have considerable experience in this area and have changed my approach to ensure that I seek out similar projects that learning can be taken from and applied to a current project, in many respects, it is a similar process to performing a literature review. Public sector organisations are encouraged to employ project managers that hold the Prince 2 practitioner certification (Newman 1997), such as myself, which encourages recording lessons learned in a log and presenting them in the project closure report. Without such a structured approach, it is not easy to learn from projects and ensure that valuable knowledge transfers to the next project (Veen 2015). To this end, I draft project closure reports for circulation, providing an opportunity for the project team and stakeholders to contribute their knowledge.

1.2.4.3 SSC Expansion in the NHS

The scope of CFH was expanded to provide a modern computerised NHS, forming part of a broader strategy that supports local surgeries and underpins large acute hospitals (Watson 2001). The objectives included permanent access to patient records and seamless, integrated care between GP's, hospitals and community care settings. CFH's mandate was to deliver electronic patient records, electronic referral & computerised prescription systems, along with the required infrastructure (Campion-Awwad et al. 2014). Healthcare innovations included remote diagnosis & care management (telemedicine) and decision support for public managers. Watson (2001) asserts that the NHS captures much information relating to the patient; however, the majority of this information has been manually recorded on paper, a finding also supported by Walley & Davies (2002). One such reason provided was that the use of computers by staff was optional. From personal observation, clinical staff find it more convenient to use paper because using electronic systems is time-consuming, technically challenging and disruptive, as asserted by Adams et al. (2007). Continuing to allow optional computer use results in seldom use and a continuation of paper-based issues such as poor legibility, errors and omissions (St. John et al. 2016).

A fundamental assertion is that staff must be adequately trained to realise the benefits of technology, which is an area that the NHS does not deliver well (Watson 2001; Devitt and Murphy 2004). I believe that rigorous IT training is a factor that influences technology acceptance. Furthermore, there is an assertion that GP practices are unable to afford investments of £40K to £80k for computer systems and so should be centrally funded (Watson 2001).

From the literature, several significant barriers to technology acceptance became apparent, and these include subjective norm, training, and financial investment (Watson 2001; Campion-Awwad et al. 2014). NPFIT had a history of delays, stakeholder opposition, and technical issues (Campion-Awwad et al. 2014). The combination of these issues, their frequency and lack of resolution were significant contributors to the failure of NPFIT and the current state of technology acceptance in the NHS. The failure meant that many of the necessary IT services

were not delivered, resulting in taxpayers incurring significantly high costs and limited value, with the root cause being a combination of haste, poor design, culture and skills (Watson 2001). As the implementation often led to a single design mandated by central government, the one size fits all approach proved to pose too many limitations and was further compounded by poor project management and issue resolution (Hefford 2011).

Reflecting on the previous 35 years of NHS IT projects, the same mistakes were made over and over again with an unwillingness to do things differently (Greenhalgh et al. 2011). The shortcomings of CFH became apparent from inside the NHS, and also within central government. As part of a Public Accounts Committee review, Bacon (2013) describes NPFIT as being 'ill-fated' and not completing its goal of revolutionising the use of technology in the NHS, having been hit by technical challenges as well as contractual wrangling. Many have concluded that there is a systemic failure in the government's ability to manage complex IT programmes (Bacon 2013; Brown 2001). Syal (2013) describes NPFIT as being the most significant IT failure ever seen, spending £10 Billion instead of its budget of £6 Billion and delivering just 10% of the planned electronic systems. The author posits that success is measured by financial performance. Others believe that with healthcare systems, the benefits outweigh the cost (Shekelle et al. 2006) and technology acceptance through system usage is a better measure, as asserted by Aggelidis and Chatzoglou (2007); Fengyi et al. (2011). The extent of the failure and the inability to make progress has become a fascination for some, including Triggle (2013a) who draws a comparison between the ease of booking a holiday and the difficulty in getting a GP appointment. Despite this, Triggle (2013a) acknowledges that CFH through NPFIT has enabled telehealth, an area of technology use that enables patient health monitoring in the comfort of their home. Home treatment should be offered to patients with long term conditions that prefer to be treated at home, where there is no difference in the level of treatment (Utens et al. 2013). Currently, such treatment is limited to just tens of thousands, so the majority of patients will require hospital visits. Many are critical of NHS IT and provide reasons. Hefford (2011) asserts that NHS technology does not meet its objectives because of government control, a one size fits all approach and limited local financial support to implement national systems. A major contributing factor was the lack

of commercial expertise amongst the staff responsible for contracting services, leading to poor procurement outcomes (Watson 2001). Ironically, this goes against the beliefs of NPM, which leverages private sector practice (McLaughlin et al. 2002).

It is worth noting that the CFH SSC did not deliver locally funded IT projects. Such projects also included the implementation of electronic patient records. These projects were locally funded either because CFH were unable to deliver it or because what was being offered by CFH was not deemed to be fit for purpose (Mark 2007; Takian 2012). One example was the implementation of electronic patient records at Aintree hospital, where the project was so successful that it won several trade awards (Pearson 2014). The use of the locally sourced electronic patient record system achieved its expected benefits, including providing a £1 Million annual saving from the reduction of fifty staff. Patient safety also improved by providing fast access to the accurate medical record at the right time. The project approach included integrating systems, making forms electronic and scanning existing paper-based patient records. Such an account is invaluable as it represents one of only a few published accounts of successful NHS technology acceptance and in this case, success was not just measured by financial performance, but also measured by patient safety. Patients see safety as being of paramount importance, as asserted by Youssef (1995). As part of this account, it would have been invaluable to understand how the project team overcame barriers to technology acceptance. Another success story involves the introduction of electronic patient records in NHS sites across the north of England concluding that there is a compelling need for IT systems to support evidence-based medicine and promote the use of data to drive improvements within healthcare (Skouras and Divanis 1998). Evidence-based medicine is the explicit use of current evidence to make decisions for patient care (Haynes and Richardson 1996). Skouras and Divanis (1998) assert that the barriers to introducing technological change in the NHS include a lack of robust solutions and issues with sharing data and systems across different NHS entities. Such borders are artificial borders, which are invisible to the patient, making it frustrating for them. The patient sees the NHS, they see the logo and the fact that the staff dress and act in a similar fashion. The patient uses their NHS number as their unique identifier at each NHS site and expects all sites to have

access to their medical history, contained within the patient record. Notwithstanding, the borders are very much in place, but only from an administrative perspective. Such boundaries exist because the funding for different types of healthcare activity is provided separately and managed differently, driven by the payment by results practice (Mannion et al. 2008). Mental health, acute hospitals, community clinics and GP's are all funded separately and have different targets. Complexity and confusion typically come into play when a patient requires more than one of these services. The patient expects integrated care (Singer et al. 2011), but often has to undergo the same procedure twice, to overcome the lack of results sharing between healthcare providers (Bardhan et al. 2014), such as with blood tests. An integrated care digital record was the first deliverable for the SSC (Watson 2001). Skouras and Divanis (1998) also provide a compelling argument for end-user training, linking IT awareness and IT skill with user satisfaction. The effects of user satisfaction on technology acceptance are highly visible and thus accessible to measure after the new technology is in place and not beforehand (Yoon 2016).

1.2.4.4 Benefits delivered by the NHS SSC

Using NPM and the SSC approach, the NHS created a centrally driven programme of work (NPFIT), whereby patients benefit from the improved capabilities of NHS, which are underpinned by technology. The technology enabled benefits are significant and differentiate the NHS from all other healthcare providers globally through a comprehensive set of national technology solutions that are available to NHS staff (Waterson 2014). In the UK, a patient can travel across the country, and clinical staff anywhere can access an electronic summary of the patient's healthcare record. Such freedoms are not possible in other countries, whereby not having a shared medical record or comprehensive infrastructure to contribute to a shared medical record is a significant barrier to treatment (Seroussi and Bouaud 2017). There are few peer-reviewed articles that discuss the technology acceptance of NHS technology solutions. The most significant NHS technology successes that have come from the SSC include: -

I. A Summary Care Record. A summary electronic record is available nationally and includes a patient's most vital information, such as allergies, reactions and prescriptions. Referred to as the "national spine", data is available to clinicians 24 hours a day, 365 days each year (Cross 2006).

II. A national computer network that links all NHS care establishments together, which enables the secure sharing of patient information and system access (Campion-Awwad et al. 2014). In my experience, the national network remains the most secure and fastest way for NHS hospitals to exchange patient data.

III. The Electronic Referral Service. An electronic system that allows clinicians to refer patients for care in real-time, which provides patients with a choice of location, date & time. The system has led to a reduction in non-attendance and has sped up appointment booking (Dusheiko and Gravelle 2018).

IV. A national electronic email platform
A secure email system built to exchange identifiable patient information between different healthcare professionals irrespective of location (Barham 2010). NHS mail has been around for over ten years and is universally accepted across the NHS as being the safest and best way to send an email.

1.3 Objectives of the research

The NHS is a large organisation, with a multitude of challenges (Pencheon 2015). These challenges manifest themselves around people, processes and finances. Observations within the workplace provide evidence to suggest that patient demand exposes operational and process deficiencies. Owing to the scale of the demand, which is considered infinite (Higgs and Jones 2001), such deficiencies lead to resource shortages. Resources in this case relate to clinical and administrative staff, facilities and equipment. Addressing all of these shortages in one go is not possible, so addressing some of the shortages leads to cost pressures in other areas. These pressures lead to delays in patient care, whereby beds are in use for longer, and a growing backlog of patient-related

activity ensues. The culmination of such problems is what I refer to as the NHS demand problem, which is also identified by Silvester et al. (2004). The relationships in the NHS demand problem can be found in figure 1.3.1 below.

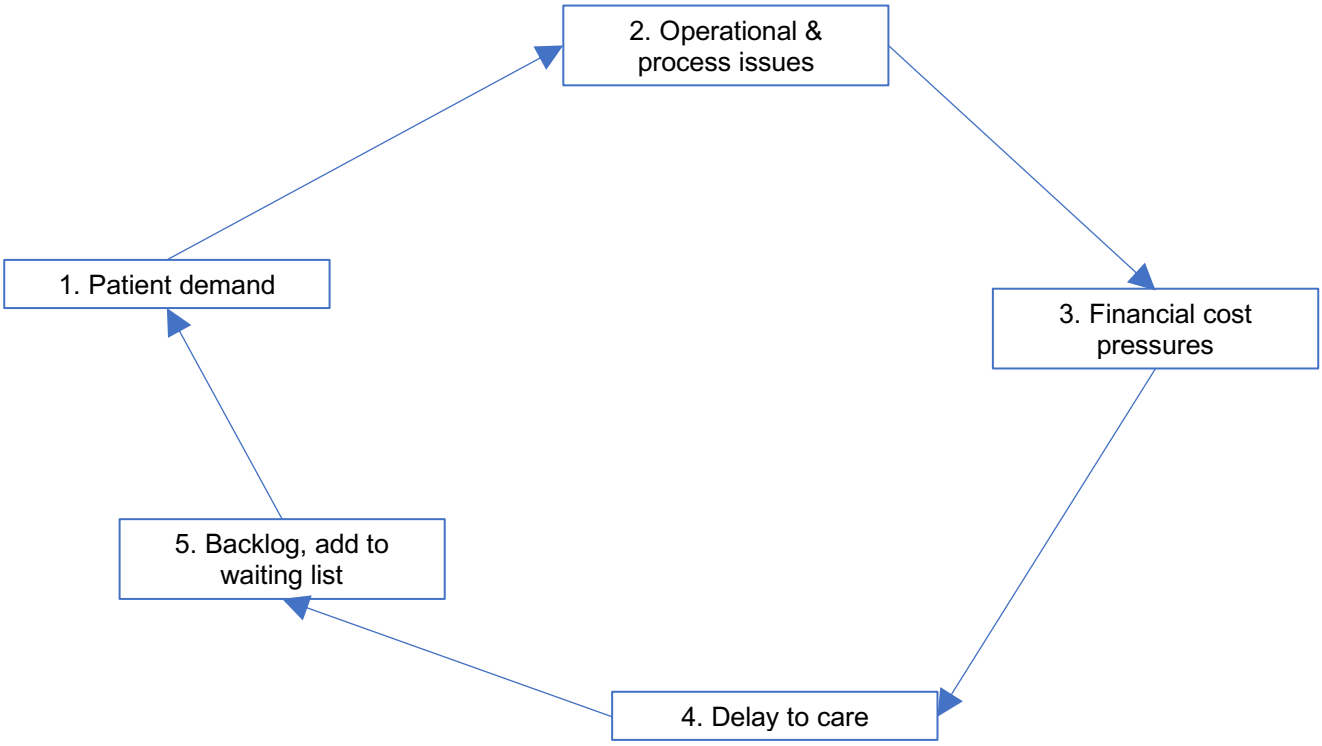

Figure 1.3.1 The NHS demand problem

Solving the NHS demand problem that I frequently observe is complicated and requires a holistic approach to healthcare, as asserted by Black (2013). There is a willingness to tackle the problem and a belief that this problem can be solved, especially when combined with a regime of preventative care (Lacobucci 2014) and the opinion of the NHS can be significantly improved (Marshall 2012). On reflection, I believe solving this problem once and for all would require a large team and a much longer time frame than permitted on the DBA programme. Instead, this research study will focus on the technology-related contributory aspects of the NHS demand problem, that fall within the Operational and process issues category. Operational issues were carefully examined to understand the role and benefits of successful technology acceptance and the most important use of technology centred around the need to implement robust electronic patient record information systems. From 1997 onwards, the NHS has been pursuing the implementation of electronic patient records (Brown 2001; Robertson et al. 2010) with a target completion of 2020 (Honeyman et al. 2016). The introduction of such technology is seen to be one possible solution to the big problem of

organisational sustainability (Visram and Temple 2017). The approach taken is to use technology to increase productivity and drive down costs, with an end goal of seeing more patients in the same 24-hour period (Sood and McNeil 2017). The extensive use of technology for this purpose has not been readily accepted by the NHS, with a large number of high-profile failed projects (Evanstad 2016). There are many such reasons for the failures, which stem from poor procurement, weak project management and lack of stakeholder engagement (Juciute 2009), along with the need for adequate training (Alpay and Russell 2002). Notwithstanding, the NHS is currently on a massive technology implementation drive, to operate without paper by 2020 (Macaulay 2016). The strategy for the year 2020 is where a patient will use self-service to book an appointment online using the Electronic Referral Service. There will be no paper-based appointment letters in the post, instead, the patient will receive a confirmation email and electronic calendar appointment containing a Quick Response (QR) code, scannable on arrival. A QR code is a type of two-dimensional bar code that is portable and readable by many mobile devices, providing quick access (Jamu et al. 2016). In this case, the data represented by the QR code would be a unique reference number for the appointment. Figure 1.3.2 provides an example QR code. Patients will scan-in at the hospital or clinic kiosk and will have an opportunity to check and update their correspondence details, removing the need for a paper-based registration form (Lowe and Cummin 2010). During the appointment, the clinical staff will access the patient's electronic patient record and review the clinical history and diagnostic tests results. The electronic patient record replaces the paper-based medical record held in the patient's folder. The clinical staff will then consult with the patient and determine the next step. Further diagnostic tests, referrals and discharge notifications would then be processed electronically, and the electronic patient record updated. A confirmation of the outcome of the appointment would then be automatically sent to the patient via email. Currently, not all of the steps described are in place, however many are, including the booking of appointments and viewing of medical records (Atherton and Majeed 2011).

Figure 1.3.2 QR code

As such, the purpose of this research is to improve the system implementation and adoption of electronic patient records in the NHS hospitals that I work at.

The primary objective is to explore the factors that influence technology acceptance of new electronic patient record systems by applying accepted theory and to deduce possible actions that can be taken to improve acceptance.

A secondary objective is to create theoretical scaffolding for other technology professionals to leverage. Specifically, using scholarly techniques, this research will extend the existing body of knowledge and will include the following activities: -

To contextualise technology success in the NHS
To assess existing theory used to understand technology acceptance.
To analyse the technology acceptance of electronic patient records
To plan activities that will improve the technology acceptance

1.4 Research Approach

The research follows the traditional approach adopted by DBA programmes, whereby a business problem is selected and a full AR cycle implemented. The initiation stage of the cycle includes defining the problem statement and the setting of objectives. Further stages in the AR cycle involve analysing the problem and planning solutions. The use of AR for this DBA study is a fundamental difference when compared with other types of Doctoral study. The primary goal of a DBA research study is to improve the professional practice of managers (Bareham et al. 2000), and AR provides a practical way of achieving this by focusing on the activities. The sole focus of AR is on obtaining practical knowledge that leads to action. There are many definitions for AR, and through powers of enquiry, Chandler and Torbert (2003) assert that there are at least twenty-seven flavours of AR. The origin of AR rests in the 1930s with Kurt Lewin, a renowned psychologist, and pioneer of applied psychology (Reason and Bradbury 2001). AR is considered to have a long-standing use in social practice (Kemmis and McTaggart 2005). A meaningful definition of AR states that it is knowledge creation that arises from working with practitioners (Bradbury-Huang

2010) and Reason and Bradbury (2001) identifies a need for the researcher to be both active and receptive. There is also an expectation that while acting, there will be learning and collaboration, which are seen to be fundamental for Information Systems Action Research (Baskerville 1999). As a researcher working within the NHS, I believe that I can demonstrate being active, receptive, collaborative and ethical.

1.4.1 Research Philosophy

Reflecting on my beliefs when being a worker and researcher, there is a constant need to ensure that personal views and values do not prejudice the gathering of data, the interpretation of information and presentation of the facts (Kanuha 2000). The research approach is founded on enquiry from the inside, as opposed to an enquiry from the outside, perspectives described by Evered and Louis (1981). By combining several research methods, this research study demonstrates the significant difference between a purely academic study and a study that is designed to solve real-life problems, a void described by Zuber-Skeet and Perry (2002). In an academic study, there will be limited emotional, and political influences, however, at work, such pressures can be invisible but play a significant part in biasing the created knowledge, limiting its usefulness (Chavez 2008).

In terms of my epistemology, I am now a proponent of interpretivism, having moved from the positivist camp. My positivist roots came from my background in Computer Science, with my prefered approach being to test facts with formula, providing a definitive answer. What I found useful when conducting this research is the analogy that you can apply the Systems Development Lifecycle (SDLC) methodology to research as promoted by Oates (2005). Using a structured approach that I was familiar with made me at home in conducting this research. As such, undertaking the statistical analysis in this research was extremely enjoyable. Notwithstanding, I also now see the need to write explanations and convince the audience through reasoning (Hage 1997), which is developing me as an interpretivist. The quantitative analysis is of particular benefit to this research, as it gives a clear indication of what the practical issues are (Brannen 1992). By blending the quantitative research with qualitative research, I put into

perspective the dialogue with key stakeholders, identifying common themes through narrative inquiry (Polkinghorne 1995). Having a long-standing career in implementing technology transformation within the NHS, there is a constant need to be mindful of personal beliefs and bias. Such an approach is essential in upholding the integrity of the research study (Bell and Bryman 2007), along with establishing a governance regime that allows for the judgement of quality, efficiency and integrity and I have been keen to demonstrate proper ethical compliance throughout this research study. The biggest issue I had to overcome was being a victim of the identified business problem and emotionally tied to it, as I have been responsible for implementing the technology solution which is at the centre of this research. As such, I must resist personal emotions and accept the facts as they avail, both positive and negative. Albeit, this is in keeping with the assertion of Smith (1997), whereby participants are motivated only if the solution to the problem is of vital importance to them. Through conducting this research, many opportunities presented themselves that allowed reflection on my actions and the influencing of outcomes. Every reflection typically led to further refinement of the approach, which included, what to research and how. The overall approach relied heavily on the use of contemporaneous reflection, the ability to reflect during a situation to reach a better outcome, which is an essential approach that has been learnt from Raelin (2001) while on the DBA programme. The contemporaneous reflection approach is better than reflecting after a situation, whereby there is no opportunity left to improve the outcome. What I now apply in my practice is the need to ask searching questions, such as “am I the cause of the problem?” and “how have I contributed to the situation?”. Before this research study, I put no thought into asking such questions or revisiting decisions. In fairness, this is a significant area where my practice has changed as my previous problem-solving approaches never commenced by asking myself any questions. My use of contemporaneous reflection, critical thinking and critical reflection are direct benefits to my practice, which I have gained from the DBA programme, which is an expected benefit (Sambrook and Stewart 2008). The other new lead-in question for me is “Why is this important to me?”. It is fair to say that my intrinsic reward comes from solving problems and helping others, both are which are visible through conducting this research. For me, having the opportunity to collaborate with others and share the learning makes conducting research enjoyable, making AR a good fit. A reflective journal

was created to note significant findings as recommended by Ortlipp (2008), and financial success as a crucial determinant of project success was the first entry.

1.4.2 The Research Advisory Group

Fundamental to the collaboration encouraged by AR was the creation of the Research Advisory Group (RAG), which was used to provide insight into the analysis and potential solutions. Creating the RAG involved bringing together a small group of individuals from my professional network. The RAG can be thought of as being similar to an Action Learning Set (ALS) but without formal terms. An ALS is specifically used to focus on critical organisational issues and involves both learning and acting (Pedler 2009), which is demonstrated throughout this research study. In doing so, such participation was found to be rewarding and had a positive impact on my leadership knowledge and skills, which was also an expectation set by Walia and Marks-Maran (2014). In the NHS, there is an everyday use of the RAG approach in problem-solving, known as a community of practice. Reflecting on the RAG that I established, I have seen that many minds brings many lenses. The increased awareness leads to far better outcomes than a single mind, which is irrespective of how experienced that one mind is. For example, I always was thought that training was a set of activities and once complete, this would be sufficient to facilitate system use. The RAG helped me to see that an end-user still needs to learn how the system functions to use it appropriately. A key realisation was that the RAG was able to provide new ideas and insight across the entire AR cycle. As such, my practice has changed, and I now leverage the RAG approach on all significant business challenges, with a current one being the need to gather structured data for clinical research.

In terms of solving NHS IT problems, there are other examples where the RAG and ALS principles have been leveraged to assist with IT issues, such as the establishment of such a group to assist the NHS North of England with IT strategy (Finlay and Marples 1998). The outcome yielded positive benefits from the approach and the overall effectiveness of the programme goals. A further successful example of creating such a group within the NHS comes from nursing, where the collaborative environment positively fostered growth by enabling staff

to constructively challenge processes and follow their heart (Rivas and Murray 2009).

1.4.3 Participation

While the collaboration aspects of AR provide great benefits such as the use of many minds, I was also keen to ensure that the views of the wider organisation were represented. It was this area that I had to think more carefully about as it involves me undertaking a dual role within the hospitals, that of technology leader and that of a researcher. The most significant issue is the conflict that this could bring with my day job, as researching a problem is different to tackling the problem immediately. In my job, there is typically no opportunity to revisit situations, I tend to complete a project and move on to the next challenge. The other significant dilemma that I had to confront is how would my colleagues view me, and if colleagues would easily be able to differentiate the activities that I undertake as a researcher from my job. After much reflection and discussion with my thesis supervisor, I settled on soliciting participation from end-users using a questionnaire which would be completed anonymously. I also extended the research to include stakeholder interviews.

1.4.4 Ethics

Research ethics concerns itself with the moral principles when conducting an activity, applying ethical standards in professional practice, as asserted by Colnerud (2013). Upholding such standard is of paramount importance to me, and so I was also keen to adopt an ethical approach across all stages of this research, from inception to final submission. As an example, the first part of this journey involved gaining approval from the University of Liverpool Ethics Committee, which had to be done before data collection could commence.

When conducting research from the inside, it is essential to pay particular attention to ethical sensitivity and awareness, as asserted by Weaver et al. (2008), which I was mindful of from the start and to the end. What you can find is that issues arise over relationships and power, whereby colleagues may want you to make exceptions to the values, as asserted by Colnerud (2013). In my case, while there were dilemmas, such as ensuring that colleagues understood

which of my dual roles that I was undertaking at any given time, there were no actual issues. The fortunate situation of no issues is attributed to two reasons. By focusing on technology acceptance and looking to improve it, there was no sense that I was trying to point the finger at colleagues. In this case colleagues would be the project team, suppliers, end-users and stakeholders. In fairness, I was ultimately responsible for implementing technology solutions, and so any blame would firmly land back on me. The concept of identifying issues that lead back to me initially posed a dilemma for me, which was more about my ego than anything else, which I quickly got passed. Secondly, the key informants were clinical staff, of which I had no significant relationship with. I believe that the lack of such a relationship helped in this case, avoiding the need for me to manage the bias that may have arisen.

1.4.5 Confirming the approach

The approach took several iterations to get right and was the most significant decision after the choice of the research topic. In creating the approach, I intended to be practical and to ensure that decisions made early on do not introduce constraints, as recommended by Bordens and Abbott (2002). Determining the best approach when tackling business problems is an area that now influences my practice, as I believe getting the approach right is crucial to the timely resolution of workplace problems. The approach for this research included confirming the choice of problem and selecting the most appropriate theory and analysis methodology. The approach that I implemented was built upon understanding what I believe to be the critical components for research in my practice. Specifically, gaining an understanding of the NHS and the hospitals that I work at, public management, technology problems and theories used to measure technology acceptance. Time was also spent reflecting on whether the NHS technology issues are considered to be the same as in the private sector, and how the NHS compared with other public sector bodies. Since the primary objective was to create actionable knowledge to improve technology acceptance, an on-going business problem was examined using AR, and the approach was approved by my thesis supervisor.

Selecting a genuine problem provides an opportunity to study a specific instance and to generalise across a more comprehensive setting (Gerring 2004). I also

opted to use a hybrid approach, that combines quantitative methods with qualitative methods, which is described as being the third methodological movement (Creswell and Clark 2011). Such fusion provides a practical understanding of situations, as asserted by Burke et al (2004). The use of a hybrid approach works well in conjunction with AR, as using this approach can more readily facilitate the creation of actionable knowledge (Lingard et al. 2008).

An integral part of the research leads to the creation of a conceptual model and a purpose-built survey instrument. The survey is used to gather the data required for the quantitative analysis and the validation of the conceptual model. Using quantitative analysis to study technology acceptance is recommended by Fayad and Paper (2015) and further endorsed by Wixom and Todd (2005). The conceptual model represents aspects of the research that adds insight for other public managers and researchers. As with many peer reviewed research studies, a qualitative analysis is also conducted. Insight is sought from the end-users of the technology to explain the current position. The use of a qualitative approach adds far more meaning to the quantitative analysis. The dialectal exchange presents instant understanding and helps share knowledge. Scales and boundaries do not typically constrain qualitative research when compared to quantitative methods, and so qualitative analysis lends itself to higher powers of enquiry (Smith 2015). In this specific case, the goal is to obtain insight into factors that influence technology acceptance. In healthcare, the use of the qualitative research method is extensive, as its application is suited to understanding phenomena within context, linking concepts and behaviours, as asserted by Bradley et al. (2007).

1.5 The contribution of the Study

Past research has examined technology success (Delone and McLean 2005), task-technology fit (Goodhue 1995) and technology acceptance (Davis 1989). Such research has developed robust models that provide insight and predictive powers (Dillon and Morris 1996). While such theoretical models exist, there are few examples where they are applied to healthcare settings and even fewer in the NHS. The limited number of scholarly articles is unfortunate, as while there are many technology initiatives in the NHS, it appears that minimal knowledge transfers between initiatives.

What separates this research study from other research is that it brings to the forefront accepted theory that can be used to examine technology-related problems in the NHS, such as TAM, which an approach promoted by Holden and Karsh (2010). The research provided in this study represents one of the few attempts to apply well known accepted theory, which will identify the factors that influence technology acceptance in the NHS. Furthermore, this study seeks to create actionable knowledge that can provide immediate improvements. The resulting knowledge extends the existing body knowledge, and there is potential for this research to become a robust foundation for future healthcare technology research.

1.6 Structure of the Thesis

The structure of this thesis represents a logical journey. It starts with an introduction into the NHS, setting the context, the practice and the challenges. The objectives of this study are then set out. A literature review follows, whereby the existing body of knowledge is laid out, providing the theoretical foundation for this research. The literature review enables the sharing of knowledge and learning from the experience of others. The literature review is broad as it describes both healthcare and public sector technology experiences, demonstrating significant similarities as the NHS forms part of the UK public sector. The literature review also introduces the relevant theory that relates to measuring technology acceptance. After identifying the most appropriate theory to assess technology acceptance, the creation of a conceptual model gets underway. The AR methodology is then set out, and quantitative analysis and

testing of the conceptual model takes place. A qualitative analysis follows and the results blended with the quantitative analysis to add further insight and to create actionable knowledge. The outcomes and knowledge is summarised, along with a reflection on the research and the DBA journey.

1.7 Chapter Conclusion

Chapter 1 set out the context and critical challenges faced by the NHS, such as tackling an unrelenting demand with limited funding (Hazzell 2016). One of the ways that the NHS is counteracting this is by becoming more efficient through technological innovation (Waterson 2014). Chapter 1 also described the research objectives, with the goal of using a significant business problem to understand the factors that influence technology acceptance in the NHS hospitals that I work at. Conducting this research is of vital importance to me as I feel responsible for ensuring that the solutions that I deliver are valuable to end-users and used appropriately, providing the full benefit. I have now learned to focus on understanding end-user behaviour, which plays an essential part in acceptance, as asserted by Abbasi et al. (2015). Overall, an essential objective of this research is for me to gain valuable knowledge and experience that can be applied to my future technology projects, reducing the risk and increasing the likelihood of success.

CHAPTER 2 RESEARCH DESIGN

2.1 Chapter Introduction

Chapter 2 sets out the plan to understand the factors that influence technology acceptance in the NHS hospitals that I work at and describes in detail the research methods that are employed along with the path taken. The main approach adopted has been the application of AR and several of its iterative cycles, which delivers on the core principles of generating knowledge for managers, as asserted by Coughlan and Coghlan (2002). The AR cycles are fully supported by the RAG, which I introduced in Chapter 1. The RAG has been assembled to help identify, analyse and resolve a specific business problem which becomes the focus of the AR activities. The activities undertaken by the RAG are also described in this chapter.

The AR cycles benefit from participation from technology users who complete a purpose-built survey. The survey will ultimately lead to the creation of a conceptual model that will be tested using quantitative analysis to validate the relationships between the constructs. Participation is gained from stakeholders through interviews and analysed using qualitative methods to provide a deeper understanding of the business problem. By reflecting on the findings of the qualitative analysis and combining it with the quantitative analysis, actionable knowledge is created. The new knowledge is used to create a targeted action plan, which is in keeping with the assertion of Denyer and Transfield (2006). Implementing an appropriate research design is crucial to being able to analyse real-life business problems while demonstrating the accepted methods and wisdom of a scholarly practitioner (Bardach 1987). Making use of more than one research method is new to me, especially the qualitative approach, which is an area where my practice has changed. In my reports at work, I now use a quantitative approach, along with narration which factors in the qualitative aspects.

The research approach I have implemented includes acknowledging past events in the NHS that have a bearing on the modern practice, as recommended by Hannu et al. (2007). A narrative account is also provided, as recommended by Pedler (2008). My use of AR predicates itself on two key concepts, identifying

and gaining an understanding of a relevant technology related business problem and then acting to improve technology acceptance. The intention is to use this research study to advance both practice and theory in NHS hospitals. My goal is to use scholarly techniques to solve a business problem and to create a framework for others to follow, both are essential outcomes for research, as asserted by Whyte (1991). Overall my research design demonstrates the use of the scholarly practice, accepted methods and a systematic approach in my practice, which is fundamental learning from the DBA programme. The significant lessons learned from this process are included at the end of the chapter.

2.2 Rationale for choosing AR

The field of social sciences has been studied by researchers for many years, leading to a rich variety of research methods. Such methods include the traditional qualitative and quantitative research methods, which are thoroughly grounded in providing scientific and absolute reasoning (Zimmerman 2000). The adoption of such methods provides opportunities to describe current problems, but these methods can lead to the creation of silos and vacuums (Dey 2003). In such situations, the researcher, problem, data and analysis live in a bubble, often fully immersed and ring-fenced away from the outside world (Jeffrey and Troman 2013). Such a problem deviates from my key goal of creating knowledge that can be used by others in the future and so I was keen to avoid research that would be isolated from the business environment that would not evolve. A desire of mine was to collaborate and to involve the participation of the user community that I service. Understanding this helped me to make the significant decision to adopt more recent research methods that would also achieve my goals, such as AR. When I researched AR, I was comforted to discover that the last twenty years have led to more opportunity for business-related researchers through their gradual adoption of AR (Coghlan and Brannick 2010). A meaningful definition of AR is that it is “a participatory, democratic process concerned with developing practical knowing in the pursuit of useful human purposes” (Reason and Bradbury 2001 as cited in Brydon-Miler et al. 2003). In simple terms, AR is all about acting to solve critical problems. On the surface, AR seemed to be the most appropriate method to adopt and in practice it delivered on all of my goals. The main reason

for this is that AR embodies collaboration concepts and the creation of mutual knowledge as asserted by Eden and Hexham (1996). Through applying AR, I found it to be a structured process whereby concerned members of an organisation can work together to solve problems of significance by pooling their time, knowledge and passion, as asserted by Somekh (2003). An additional benefit that I found is that AR offers continual improvement and so is well suited to information systems research which continues to evolve, as asserted by Baskerville (1999). Above all else what makes AR work best for my research is that it is designed for research from the inside, the creation of actionable knowledge (Jagosh et all 2012) and provides me with the opportunity to put into practice everything learned on the DBA programme.

Overall, this research study has been designed to execute AR cycles to create knowledge and plan action to solve problems, which is a well-documented outcome of AR (Coghlan and Brannick 2010; Stringer 2013, O'Leary 2004; Kemmis et al. 2014; Tripp 1995). What I have found is that while AR is compatible with researching from the inside, it is left to the researcher to determine the best way of eliminating bias within themselves and to mitigate the bias of their colleagues.

2.3 AR Design

AR is iterative and cyclical in nature, which is what separates AR from the pure theory-based research instruments. Theoretic instruments are used to determine a conclusion; however, AR stages can be repeated many times until the desired outcome is achieved (O'Leary 2004), which is depicted in Figure 2.3.1.

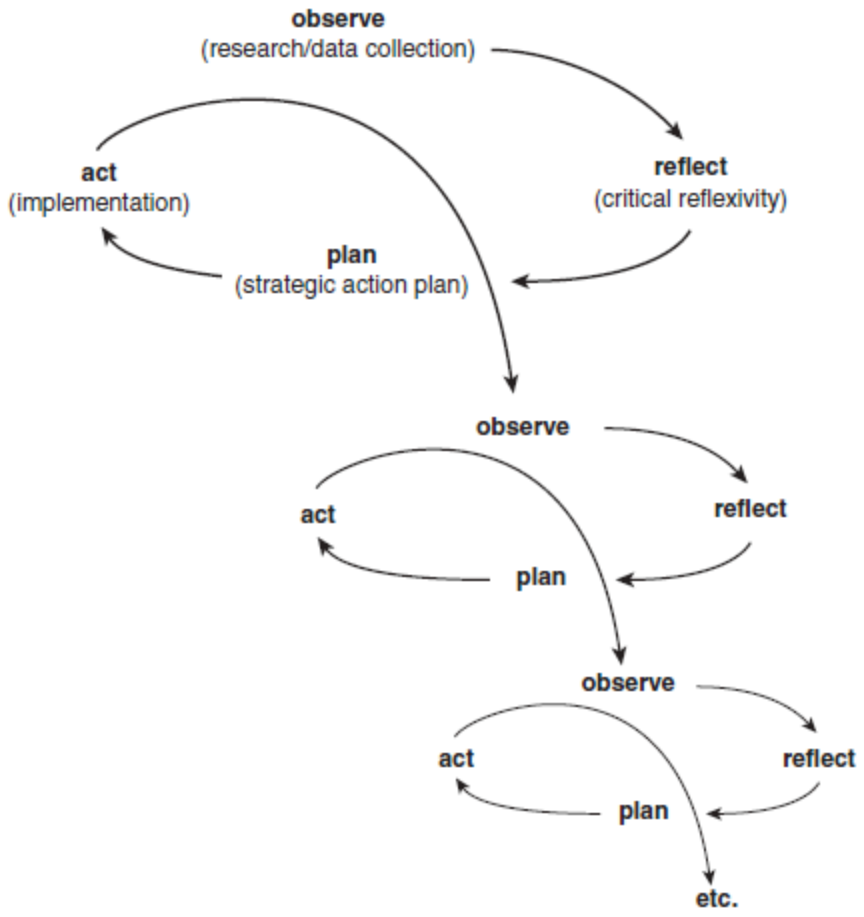

Figure 2.3.1 O'Leary (2004) Action Research cycle

With the AR methodology, complex problems may require many AR cycles. My belief is that the infinite nature of AR makes it the best fit for the NHS, as it is not constrained by a definitive end. It is this infinite behaviour that I believe Lewin (1946) was looking to create when he first pioneered AR, with AR continually growing, developing and responding to current business issues. One thing that I have found is that AR is not solely an analytical methodology and so does not replace quantitative or qualitative analysis, but works in conjunction with them. In my case, I benefitted from the flexibility of AR, which leaves the choice of analytical methodology at the discretion of the researcher, which has enabled me to align my research method with the NHS hospitals. To this end, the AR cycles that I implemented are depicted in figure 2.3.2.

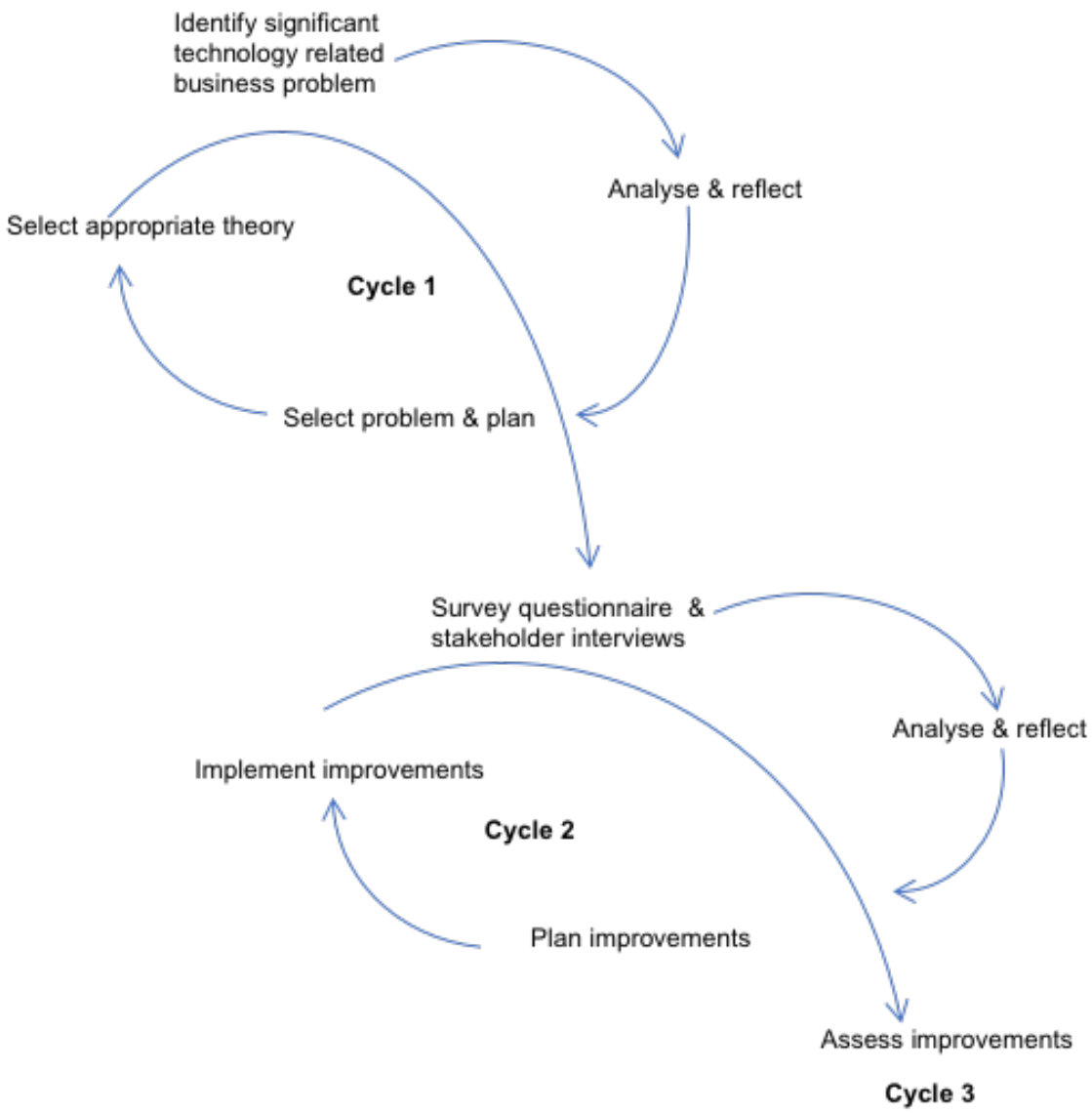

Figure 2.3.2 Implementation of AR cycles

The approach I took was to use the first AR cycle to observe the NHS hospitals, with the goal of identifying a significant technology related problem to focus on. As a hybrid research approach is employed, which can be considered as one of the three dominant research paradigms (Burke et al. 2007), a second AR cycle was used to gather data combining the qualitative and quantitative research paradigms, as asserted by Bansai and Corley (2011). The hybrid approach provides the what and the why and allows for a greater dialectal appreciation (Walton 2010). For technology acceptance research, Wu (2012) asserts that much value can be derived by combining paradigms. Leveraging multiple methods to create actionable knowledge is an advantage of the DBA approach (Cameron and Molina-Azorin 2011). Such an approach supports the bringing

together of aspects from the Auguste Comte positivist paradigm with the interpretivist paradigm used in many healthcare studies (Sale et al. 2002). The hybrid approach is endorsed by Lin (1998), who asserts that positivist work collects data and identifies those details with testable propositions, while interpretive work seeks to combine those details into systems of belief.

The second AR cycle through its stages was used to plan and implement improvements. The blending of quantitative and qualitative analysis with AR is not a new concept, as asserted by Ikankova (2015). The methods complement each other, as they follow the principles of systematic enquiry and are dialectal, discovering the truth through discourse and reasoned arguments, confronting issues and overcoming them with a shared understanding (Heikkinen et al. 2012). These approaches transition from exploration, to explanation and then confirmation.

One aspect that I was keen to continually monitor as part the research design was the fact that I was researching from the inside. Being known to the hospitals as a technology leader and perhaps also to one or more participants may positively or negatively influence the behaviour, participation and responses of colleagues. A major concern was to be able to truly analyse the business problem for what it is and not what people think that I would like to hear. As such, the use of quantitative analysis with anonymous feedback was selected to reduce the likelihood of bias. In line with the iterative nature of AR, a third cycle was commenced to assess the effectiveness of the action implemented in the second AR and to plan further action. Subsequent cycles could also then be invoked until the desired outcome is achieved.

2.4 How this study applied AR

This section steps through the significant activities that I undertook as part of executing the AR cycles based on the O'Leary (2004) approach. As AR is a well-documented and structured methodology, it served as a map through the research process, simplifying the undertaking. Using AR, I demonstrate a carefully designed journey from planning, all the way through to acting. The RAG also assisted with the implementation of AR, which is discussed in section 2.6.

2.4.1 Selecting a focus

Problem identification was the most crucial activity, as an inappropriate problem would limit the value of this research. The problem needed to be something significant to the business that could benefit from AR and my attention, as I am always mindful of the dual role that I now play. The objective was to choose a problem whereby enquiry from the inside could leverage my knowledge of the workplace and experience. The challenge was that I work in a complex environment that is impacted by many business problems, as introduced in Chapter 1. The NHS has a significant amount of specialised staff, who work in specific areas with clear boundaries and their interaction with other departments, people, processes and challenges are limited. My role as an IT transformation leader is different, as it enables me to work across NHS hospitals interacting with all functions, clinical and administrative, such as hospital wards, clinics and theatres, as well as administrative departments such as Estates, Finance, Human Resources and operational leadership. A RAG was formed comprising of other technology evangelists who also had far-reaching roles. As part of the first AR cycle, the RAG used its combined experience to identify and review several business problems. After an in-depth discussion, the RAG agreed on the problem to focus on based on the benefits and learning opportunity. One such benefit of utilising a RAG is the fresh perspectives that many minds bring to a common problem (Revans 1982). Selecting the phenomenon to study represented the first and most crucial milestone required to get the AR cycle underway.

2.4.2 Selecting appropriate theory

A critical literature review is included in Chapter 3, which revealed existing knowledge, theory and techniques that could be used to understand the factors that influence technology acceptance in the NHS hospitals. Developing the methodology involved thinking ahead and determining what methods would be best suited to tackling the business problem. With the methodology selected, which is discussed in detail in Chapter 3, we progressed naturally to the second AR cycle.

2.4.3 Developing the research questions

The second AR cycle commenced by using the research methods identified in the first AR cycle. The first stage was to gather data. Research questions came from insight provided by the RAG. The RAG proposed several factors that influence technology acceptance, which were then investigated and matched to tested theory found in other research. The proposed factors are discussed in detail in the literature review.

2.4.4 Data collection

Participation from end-users was paramount and built in to the research design. Using the hybrid approach led to undertaking two data collection stages. Collecting the data for the quantitative analysis involved issuing a survey instrument to end-users. Collecting data for the qualitative analysis was conducted by interviewing stakeholders, who I refer to as key informants. In other forms of structured analysis, the researcher must tread carefully so that their presence does not bias the information gathered (Winter 1996). Once again the dual role that I play was on my mind, along with the the need for me to make clear to participants which hat I was wearing.

2.4.5 Analyse

On reflection, owing to the hybrid approach, the analysis stage of the second AR cycle was the most complicated, as it required combining multiple methods to obtain the best reasoning, as recommended by Leech et al. (2010). The quantitative analysis was also used to test a conceptual model for the NHS hospitals to adopt. The qualitative analysis involved distilling knowledge from key informants.

2.4.6 Document results

The findings from the quantitative analysis and qualitative analysis were documented using traditional research practice. The qualitative analysis was cross-referenced with the quantitative analysis, and the results summarised. By synthesising the results and reflecting, several recommendations and actions were discussed and agreed by the RAG.

2.4.7 Taking informed action (Act)

Taking informed action to improve the situation with technical acceptance represents the doing part of the AR methodology, where the researcher becomes instrumental in implementing solutions, having understood the problem through analysis. An interesting observation was that RAG members were all keen to drive improvements within the workplace. My belief is that the collaboration and learning aspects of AR provides encouragement, which is what separates AR from other methodologies, as asserted by Lewin (1966). Implementing the action marked the end of the second AR cycle. A third AR cycle was commenced to assess the benefits of the action implemented in the second cycle.

2.6 The Research Advisory Group (RAG)

In addition to using the traditional quantitative and qualitative approach often present in theoretical studies (Todd et al. 2004), a significant decision was made to further enhance the research by blending the approach with the inclusion of a RAG. The concept behind the RAG is similar to the ALS approach developed by Revans (2012), by encouraging development through the solving of complex problems but without the responsibility. The approach goes beyond pure research as it also involves acting on the facts and my intention was to use collaboration to resolve matters of genuine concern, which I believe is the intended use of AR, as asserted by Eden and Huxham (1996). As such, this research promotes mutual benefit and further promotes a significant level of collaborative and participatory involvement in the workplace. Blending such research techniques would not typically be possible, and is one of the benefits that I bring to the NHS hospitals as a DBA scholarly practitioner. Developing different ways to solve a business problem is a unique benefit that the group brings (Pedler 2008).

My ultimate goal here was twofold, I am aware that as a researcher I have a single lens and so I wanted my research to benefit from multiple perspectives. My other objective was to make research more enjoyable through collaboration. Although not an initial goal, I quickly realised that RAG members were all learning from each other, which was an added benefit.

2.6.1 The composition of the RAG

Establishing the RAG involved bringing together representatives that were experienced in delivering technology transformation in the NHS hospitals. The field of IT comprises of sub specialities such as service management, support, training and systems. Selecting experienced professionals that had excellent problem-solving skills was essential, and so the purposive sampling method was used, and candidates were drawn from my professional network, as recommended by my Thesis supervisor. Purposive sampling, like convenience sampling, is a non-probability sampling method. It is used to provide a logical representation of the population, as asserted by Lavrakas (2008). The benefit of purposive sampling over other sampling methods is that it involves selecting only local respondents who are most likely to add value (Kemper et al. 2003). The inclusion criteria stipulated a minimum of fifteen years IT experience and there were no exclusion criteria. In this case, the population was twelve, and the RAG comprised of four individuals. Each RAG member represented an IT specialism, with a combined experience of over one hundred years. The use of the purposive sampling method ensured an excellent fit for the business problem as it fostered the need for collaboration and a shared learning experience. Table 2.6.1 below introduces the RAG members.

Member	Specialty	Experience (years)
1	IT Management	30
2	Systems training	27
3	Business/Systems Analysis	24
4	User support	20

Table 2.6.1 RAG Members

The RAG would be used to assist in selecting a business problem to focus on. As it was not clear at this stage what factors influence IT acceptance in the NHS hospitals, the membership was intentionally designed to represent diverse areas of IT. Such diversity guarantees a rich mix of problems being brought to the table, along with multiple perspectives and innovative way of solving issues. The rationale behind ensuring diverse perspectives was also to avoid a phenomenon known as groupthink. Groupthink relates to a psychological phenomenon whereby members of the group end up agreeing with each other to avoid conflict, which often leads to dysfunctional decision making (Janis 1973). Groupthink was not a new experience for me; however, it is not overtly apparent when it is happening, and people tend to fall into this method of behaviour and acceptance. The result is that the group fails to achieve as much as it could have done. My approach was to keep gently pushing past issues that were frustrating for the group, getting members beyond the impossible to agreeing what was tangible. The gentle but focussed approach has encouraged meaningful dialogue and for all members to think more critically. My practice in this area has subsequently changed, whereby I no longer rely solely on IT professionals but also now encourage end-users to participate in these types of shared learning and problem-solving activities.

2.6.2 RAG Planning

The RAG was established as a forum to advance the research objectives, a place where an experienced group could collectively understand the factors that influence IT acceptance in our NHS hospitals. All members were keen to learn more about technology acceptance as a learning objective, as it could help explain why we often come across issues in the work place, possibly providing an opportunity to reduce or avoid the issues. Members were also keen to learn from each other and the overall learning objective was to gain actionable knowledge. The research and collaboration were relevant to all members and mutually beneficial. As such, RAG meetings would precede each key stage of the research, from problem identification to reviewing and planning action. By design RAG participation was setup not to be onerous and to be useful and enjoyable. The key activities for the RAG members were similar to that of an ALS and were established as: -

- Active listening
- To support and encourage
- Ask questions to encourage a better understanding
- To probe and challenge where appropriate
- Give honest feedback
- Exchange ideas to advance the problem

In keeping with the recommendations of Pedler (2008), RAG business was kept confidential. All information, views and opinions volunteered by members were kept anonymous. During RAG meetings, useful information, thoughts and ideas were initially handwritten; the anonymous data was entered on the computer and stored on a laptop computer encrypted hard-drive, for later analysis. Regular backups of the data took place and paper copies destroyed. There was no transmission of the data gathered to third parties. The RAG convened half a dozen times, aligning to critical stages of the AR cycle, from agreeing on the idea, reflecting on the research findings and acting. The meeting schedule is included in table 2.6.2 below.

Meeting	Research Purpose
1	Inaugural meeting & problem identification
2	Agreeing the factors to research & method
3	Pre-testing of survey instrument
4	Analysis of results
5	Agree action
6	Wash-up - review outcomes

Table 2.6.2 RAG meetings

The RAG had an inaugural meeting (Meeting 1), where members were introduced to the RAG concept and rules. It also served as a forum to share knowledge and experience. A key outcome of the meeting was to agree on the problem to focus on. An Observe stage meeting followed (Meeting 2), where the factors to investigate were determined. A further Observe stage meeting (Meeting 3) was held to pre-test the questionnaire used to test the factors that were previously agreed. The RAG next met as part of the Reflect stage (Meeting 4) to review and discuss the survey findings. A further meeting was held as part of the Plan stage to plan action (Meeting 5). A final wash-up meeting (Meeting 6) was held

at the end of the Act stage to discuss the outcomes. At the start each meeting, the RAG would reflect on the previous meeting and at the end of each meeting, the RAG would agree on the scope of the next meeting. The number of meetings felt right as it was not overbearing, and it was important not to impose on members so as not to impact their professional commitments.

At every AR stage and at each RAG meeting, I was mindful of the dual role that I was playing as a colleague and researcher. In terms of the RAG, my role was that of facilitator, providing all members will an opportunity for equal say. I believe that RAG members appreciated me wearing the researcher hat as opposed to my leader hat, which made the RAG an informal and a truly collaborative environment.

The inaugural meeting served as an induction, whereby I brought to the RAG some of the prior learnings from the DBA programme and introduced the different problems that we could focus on, along with the underlying TAM theory. A key delivery mechanism was the explanation of a “rich picture” of the NHS hospitals, which synthesised our understanding, promoting a view of the importance of electronic records. The “rich picture” is a communicative concept developed by Checkland (1981) as part of the Soft Systems Methodology. The “rich picture” captured key organisational relationships. The patient is at the heart of everything the NHS hospitals do. Everything known about the patient belongs in the patient record. All activity conducted for the patient, which includes the work conducted by doctors, nurses, surgeons and scientists are entered into the patient record. Some elements of the patient record may exist on paper, such as diagnosis and other elements may exist electronic, such as laboratory results. A “rich picture” is an invaluable tool, as it demonstrates the fact that the patient record is pivotal to patient care and provides a way of visualising the biases, behaviours and practices of stakeholders. The patient record is the only thing that links the clinical staff to the patient. The “rich picture” is included in Figure 2.6.2.

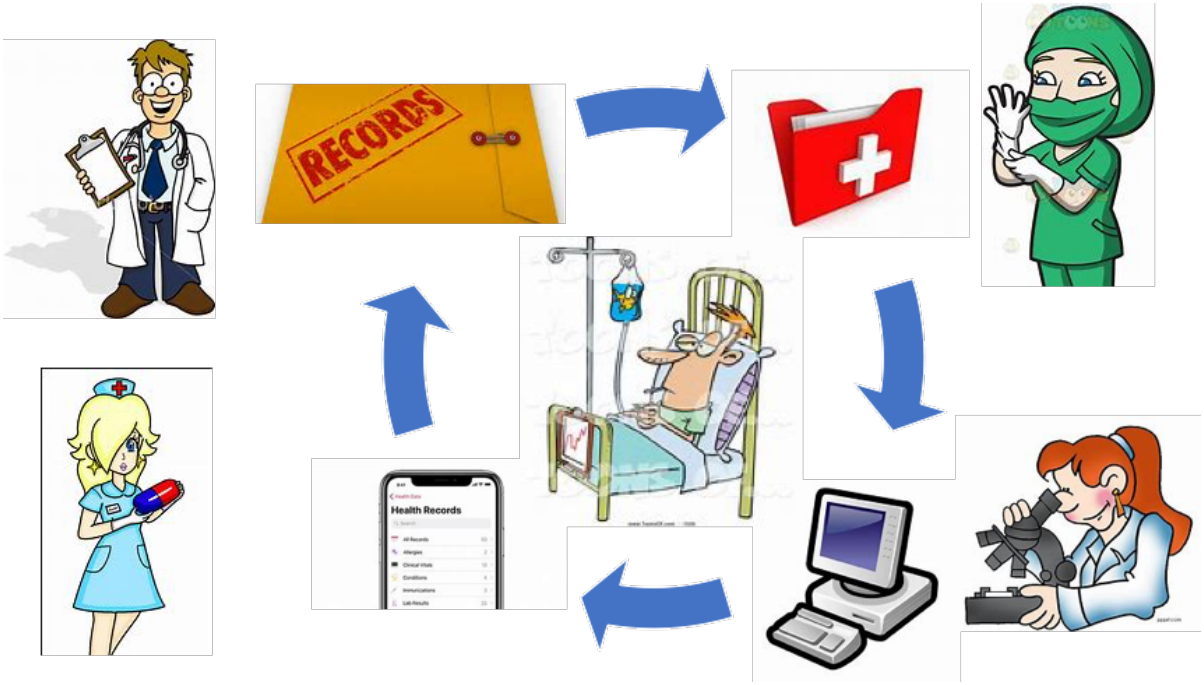

Figure 2.6.2 The rich picture

The RAG was keen to understand what the barriers were in moving from paper-based patient records to electronic patient records. The use of AR combined with the RAG provided an alternative way to understand what promotes user adoption and technology acceptance in the NHS hospitals. A benefit was that the RAG found better approaches to this problem by identifying the barriers to successful user adoption and technology acceptance, as opposed to identifying ways of improving it. One such barrier included the lack of stakeholder engagement. As the RAG met in an informal setting, no one member was on the hook to provide answers or solutions, the goal was to contribute experience and to express a willingness to solve the business problem. There was no pressure, and what helped is that all RAG members demonstrated a willingness to listen and share what they have learned in the field. The goal itself was well understood, and all members continued to meet to advance the research. One possible reason why the RAG members worked well together is that we all had a belief that the knowledge and experience would be transferable to future projects. As the subsequent meetings were aligned to specific AR stages, the insight provided is discussed throughout the following chapters. Appendix A contains an excerpt of a RAG meeting.

2.6.3 RAG Action

The RAG was founded to share insight into technology acceptance and to advance learning and improvements as part of the AR process. The RAG was therefore instrumental across all of the AR stages. The research commenced with a constructing stage, where the problem identification, confirmation and problematisation process took place. Following stages included analysing, planning action, acting and evaluating action, as described by Coghlan and Brannick (2010). During these stages, the RAG assembled and started the shared learning and shared problem-solving processes. During the planning stage, the RAG discussed numerous challenges for the NHS hospitals, the state of technology acceptance, technology initiatives, barriers to change, what has worked well, and possible future initiatives. The RAG initially posited some radical ideas, such as replacing everything and with a little bit of tact and diplomacy, I was able to move the RAG past this, refocussing the RAG on understanding factors that influence technology acceptance. The RAG was quick to identify training and insufficient computers as two factors. The RAG then progressed into raising issues such as the graphical user interface, system layout, functions, speed, performance, job role, non-mandatory use, reputation and prestige. After determining that not all of these factors were supportable with the underlying theory, there was consensus on ease of use, usefulness, image, subjective norm, resources and performance, which became constructs in the conceptual model. Collaboration included the sharing of what works well, so that RAG members had something tangible to take away and use in their practice. There was a long list of other ideas, such as implementing electronic forms so that paper would not be used in the first instance. There was always a massive potential for the RAG to open up new possibilities. Some of the dialogue included the effects of colour, screen layouts, documentation, floor walking and executive buy-in, all with some form of influence on adoption. Another critical concept worth understanding is if technology innovation is influencing the performance of the NHS hospitals. One high profile factor that the RAG discussed was IG. IG is one area that almost de-railed the NHS SSC (Smith 2010). Although IG training is mandatory for all staff, several incidents occur each year. During 2007, the NHS contributed to 287 data breaches (Smith 2010). Some cases have included staff viewing the clinical information of high-

profile patients, e.g. television actors that are not under their care. Another factor mentioned was that hospital technology tends to change infrequently and is often obsolete, as asserted by Gayle et al. (2017). As an example, many hospital staff use Windows XP and Office 2003 in the workplace, but use Windows 10 and Office 365 at home. Using old technology can be frustrating for staff, especially as it is typically legacy applications that delay upgrades. Such issues may influence an end-user's attitude towards IT. A vital thought provoker for the RAG was reviewing the quantitative analysis results, which provided evidence of the technology problem that we were researching. Reviewing the survey results with the RAG was a rewarding experience, as we were all keen to know what the real situation was and what the results represented. By presenting the survey results alongside the insight provided from the qualitative analysis allowed for an illuminating discussion. It was the qualitative analysis that provided the meaning behind the survey results and how action could be planned. Significant findings such as not being able to search, having insufficient computers and slow system performance were enlightening. Naturally, RAG members were pleased to see that issues such as training became prevalent, which proved their hunch. Another surprise was that prestige and image had no real influence. The RAG then turned its attention to planning action to improve technology acceptance now that the factors that influence technology acceptance were known. Solutions such as electronic learning (e-learning), management buy-in, creating user groups, adding more computers and fixing the performance issues all came to light. As part of the second AR cycle, the implementation of the RAG recommendations took place, and Chapter 4 describes the actions taken.

2.6.4 RAG Observation – Dynamics and contributions of the RAG

Over the past five years, I have become more self-aware and understand that as a researcher, I can influence the research findings both positively and negatively. My experience has provided an awareness of the challenges that researching from the inside has on the rigour and relevance of the research. A fundamental assertion is that by design, AR is an enquiry from the inside approach, with an expectation that some bias may exist. It is therefore essential to combine this approach with critical reflection, to ensure that not too much bias is present. A common danger associated with researching from the inside is going native, as

asserted by Easterby-Smith et al. (2013). To safeguard me from this, I took the facilitator role within the RAG, respectful of other member's opinions and allowing people with less experience the time to put their ideas forward. My contributions were therefor as a researcher and not as a critic. The approach I used with the RAG was to ask questions rather than to pass judgement, and I encouraged others to do the same. Asking insightful questions is a technique encouraged by Marquardt (2007), and by asking questions, it made it possible for RAG members to contribute openly, as no idea was seen as being stupid. It was Evered and Louis (1981) that introduced the concepts of enquiry from the inside, versus the well-established enquiry from the outside.

The diversity of the RAG allowed the business problem to benefit from many lenses, alternative viewpoints and areas of enquiry. The insight from the RAG added a higher level of interpretation to the analysis, which led to better actionable knowledge, far more than I could have provided on my own. For example, my thoughts on the system use was that it was easy to use, and users could pick it up by themselves. The RAG dispelled this myth. By sharing our experiences, we identified avenues that have previously proved unsuccessful and eliminated them before tripping over them. An example of this was the idea of providing faster computers, which had already been done in some areas but was not found to help the acceptance of specific systems. It did, however, make logging-in to the computer quicker. The RAG helped to garner opinions and implement knowledge formed from real-life experiences. Often such experiences are born out of previous mistakes. This collective knowledge and shared experiences have helped to verify the appropriateness of the TAM core constructs and original concepts identified by Davis (1989) for use in the NHS. The question that the RAG was keen to address was, are these constructs still relevant in an NHS environment and does Perceived usefulness outweigh Perceived ease of use? Specifically, the use of the RAG also helped to gain insight into what the barriers are to paperless working and IT-enabled change in hospital environments, bringing to the table factors such speed and resources. On reflection, what made the RAG different to a typical working environment was that it was brought together to solve a particular problem and can be disbanded at any time. Such an assembly is similar to the "Just in Time" (JIT) methodology, that is extensively used in manufacturing to avoid waste (Goddard 2001). With

regular teams, it can be challenging to solve problems collaboratively, as there is a need to work around the issues of the individuals, requiring much focus on improving the team first (Dyer 1987). One other major problem experienced in the past is that some staff are difficult to motivate, of which motivating others is an essential skill of a leader in healthcare (Staren 2009). Motivating teams is another area where my practice has changed, and I now create small communities of interest and task and finish groups, similar to the RAG, providing all members with a sense of achievement.

On reflection, there was no conflict within the RAG, which may have been because the RAG setup was an informal group with no ties to job performance. Another possible reason is that all of the RAG members were intrigued by the findings. In any case, working as part of the RAG was an enjoyable and rewarding experience for all.

2.7 Chapter conclusion

Chapter 2 set out the research design and introduced two concepts that are fundamental to this research. The research design has been predicated on AR, which is used to observe, reflect, plan and act. Fundamental to this approach is the creation of the RAG, a collection of concerned specialists who have been brought together to enhance the problem solving and aid the delivery of improvements in practice. The next chapter introduces the business problem and related theory.

CHAPTER 3 PROBLEM DEFINITION & LITERATURE REVIEW

3.1 Chapter Introduction

Chapter 3 introduces a significant business problem that this research focuses on. By analysing the problem, the factors that influence technology acceptance within the NHS hospitals are exposed. By exposing such factors and analysing them further, action can be planned, which offers improvements in the operational environment. Furthermore, the knowledge gained through this process can be used by other practitioners and researchers alike to further advance the area of technology acceptance. The process of identifying a problem to focus on was conducted by the RAG. In designing this research, my goal was to ensure that the research was built on collaboration and participation. In doing so, I believe that this approach would significantly aid my development, while also improving my current practice, providing all round benefit. At the inaugural RAG meeting, members studied the rich picture and each reflected on the problems in the work place that they had experienced. As a RAG member, I also participated in the process, bringing to the group ideas that I had when building the RAG along with reflections on my initial research. Collectively the RAG reviewed the problems, and evaluated them in terms of significance and the overall research objective of gaining insight in to the factors that influence technology acceptance. The RAG settled on a significant problem, which not only meets the research objectives but is also a topic that meets our learning objectives, offering practical knowledge which can be carried forwards in future IT engagements. The business problem is analysed in depth in the coming chapters.

The literature review contained in this chapter exposes information, data, and evidence to gain insight into the business problem and the resolution (Ackerman and Arbour 2016). Through the literature review, I provide an account of the existing body of knowledge and frame the most appropriate theory (Boote and Beile 2005), exposing the facts that underpin this research study. As the business problem is set in the NHS hospitals that I work at, the NHS operating environment, new public management structure and the genesis of the NHS IT shared service centre is described in detail. The shared service centre delivery

model is at the heart of how the NHS implements technology innovation. Such a setup makes the NHS unique when compared to the way other healthcare providers implement technology innovation. It is therefore essential for Information Systems (IS) researchers to understand the setting before they can apply theory, as asserted by McLeod & Clark (2009). The literature review also introduces factors that influence technology acceptance in the NHS and reasons for failure, along with an in-depth review of the Technology Acceptance Model (Davis 1989). TAM is the methodology that I have specifically chosen to analyse and predict user acceptance. The learning from the literature review is summarised at the end of the chapter.

3.2 Problematisation

Working for a large establishment that has an ever-increasing reliance on technology presents many problems and challenges. In my professional role, I see a subset of these technology related challenges and form opinions. Other members of the IT department, my team and the wider hospital also experience these issues and form their own opinions. Within the RAG, we shared our experiences and gave each other an insight in to the lens that we use when see such issues within our hospitals. What was interesting is that we shared experiences, ideas feelings that we had not previously shared in our professional setting. While this process led to several problems being discussed of varying significance, it was the rich picture that was introduced in Chapter 2, that brought us all together and provided the focus. The rich picture centres around the patient and demonstrates how important patient records are to the hospitals. The RAG then began to hone in on some of the earlier ideas to see how they relate to this important fact. Several problems were then discussed in detail that focussed on electronic patient records, which then surfaced the issues around one specific system implementation that we were all aware off. The benefit of focusing on this system was that it was likely to expose factors that had been missed in the original implementation, creating actionable knowledge. Understanding this problem more could also lead to improvements for the hospitals.

Based on RAG members experience, which was essential to their selection, members share a common pre-understanding relating to the importance of

medical records and specifically the business problem. The contextual setting for the business problem is the introduction of a new electronic patient record system in the NHS hospitals, which represents a multi-million-pound investment. The innovative technology is intended to streamline patient care by making information that exists on paper available electronically. The electronic record is available from anywhere within the healthcare setting, which means in the clinic, on the ward, or at a patient's home. A patient's medical record (referred to as the patient record), contains the history of all procedures, diagnostics, diagnosis, discharges and correspondence (Donnelly 2005; Heath & Luff,1996). The patient record is typically paper-based and collated in folders, known as the medical record. The correct storage location for medical records is a centralised medical records library, which resembles a book library or warehouse with racks full of document folders. The medical records library is one or more distributed storage rooms located either onsite or at an external outsourced storage facility (Grzybowski 2008). Figure 3.2.1 provides a picture of a medical records library. Staff request the medical record for a patient and it is then delivered by records staff for review or updating. Medical records are returned to the library when no longer required. Transferring the medical records can take several days, whereby the medical record is unavailable to staff. The unavailability of the medical record has the potential to delay patient care and limit clinical decision making. In some cases, the medical record goes missing and is re-created with all available documentation. Handling medical records presents a large number of risks, including misfiling, left in a drawer, theft, destruction or removed from the site. None of these actions should happen, however, Medical record librarians often chase staff at the last known location to return the medical record. The information stored in the patient folder is invaluable and essential to patient care (Freeman et al. 2003). As such, the handling and transport process of the patient folders containing the paper-based records are well understood and well-executed.

Figure 3.2.1 Medical records library

The NHS hospitals commenced the procurement of a new Electronic Patient Record system that would directly replace the patient folders and paper-based patient records. The product chosen was referred to as EDM (Electronic Document Management) and represented a multi-million-pound investment in technology. As part of this process, the historic paper-based record would be scanned into EDM then destroyed. A key benefit of EDM was the immediate sharing of the patient's medical history to appropriate staff via a computer. By reducing paper, monetary savings were expected from a reduction in library staff, printing and fewer delays to patient care.

The timeline for the project activities was as follows: -

- The first nine months was spent on project initiation, installation, configuration and testing.

- A deployment to pilot areas followed over a six-month period. Educational seminars were advertised to staff. The rollout process involved sending the patient folders containing the patient medical history off-site to a specialist document scanning service. The scanning service provider would scan the records within 48 hours, whereby the record would only be available in electronic form in EDM from that point onwards. The paper contents of each folder were then destroyed. The electronic folder structure in EDM containing the historical patient record is called "Legacy". All newly created paper for a patient is placed in a temporary purple folder and sent away for scanning. Figure 3.2.2 contains a picture of the

temporary purple folder. Once scanned, the electronic version appears in EDM in a folder structure called “Day forward” and the paper destroyed. Understanding the electronic folder structure in EDM is essential because the content and features available are not the same. Owing to the volume of documents awaiting scanning for “Legacy”, a project decision was made agreeing that these documents would not be full text searchable. Making them searchable would have meant spending time determining the purpose of the document and appropriately coding it for indexing. Multiply this activity by thousands of folders each containing many pages, and it is a time consuming and expensive process. The process for “Day forward” documents is that they are marked accordingly as part of the scanning process and so are fully indexed and searchable.

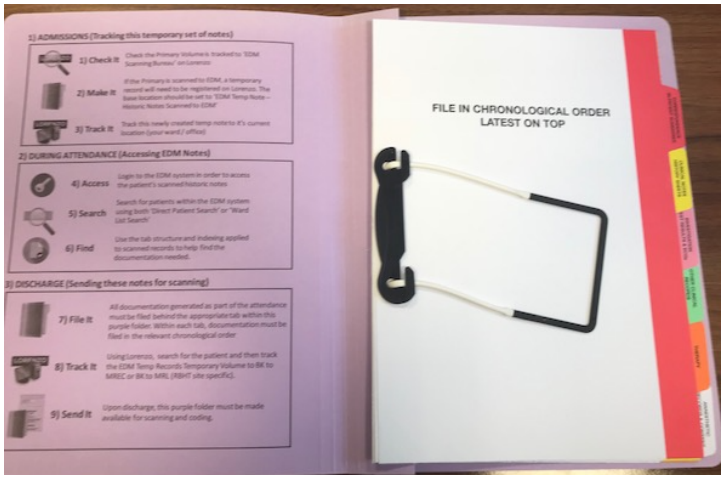

Figure 3.2.2 Temporary purple folder for “Day forward.”

- The EDM implementation completed in all areas by and all legacy patient records scanned.

- Since the pilot commenced and ever since, the number of complaints relating to EDM and accessing patient records increased significantly. The common themes were: -
    - “takes too long to display the documents/not quick enough.”
    - “Unable to find what I am looking for/Unable to search.”
    - “Documents are taking too long to show up in the system.”

Since deploying EDM, there have been reports from across the hospitals that the technology acceptance of the system has been limited. Reflecting on the busines

case used to justify the purchase, there was a need to improve acceptance of the technology to realise the full benefits and monetary savings. Combining usage information from the system with anecdotal feedback from hospital staff confirmed that there was limited acceptance of the technological innovation by end-users. Not much more could be discerned and what was realised was that action was required to maximise the benefit, as recommended by Venkatesh and Bala (2008). The phenomenon relating to the technology acceptance of the EDM system represented an ideal problem to apply AR to, as AR uses an evidence-based approach to implement improvements (Meyer 2000).

The research in to the business problem takes place across two NHS acute hospital sites that implemented the same electronic system six months before the research study commenced. Both hospitals adopted the same clinical practice and standard operating procedures, which has been embedded for over ten years prior to the research commencing. My professional role at the time was that of a Transformation Programme Manager, the person responsible for the team that configured and deployed the solution at both hospital sites. After the deployment completed, the project team provided a service transition to a smaller operational support team and the project team was disbanded, which is custom & practice. It is fair to say that the majority of issues relating to technology acceptance of this system stem from how the system was configured and implemented and so I would have been ultimately responsible for the success or failure of the technology acceptance. After the project team was disbanded, I moved on to directing technology transformations in other areas, forming a new team. What this research demonstrates is the need to revisit complete projects to confirm if they are achieving their benefits, just a like an additional AR cycle would. Where my practice has changed is that I am keen to recommend this approach upfront with new projects, focusing on outcomes even at the outset.

The research examines the following problem statement: -

> Can the technology acceptance of the EDM system be improved for the hospital staff?

The problem described here is relevant for public managers. There is also value for technology suppliers and technology researchers, as the knowledge aids product creation and marketability. Furthermore, full acceptance of the technology benefits the patient (Atkins and Cullen 2013).

The collaborative approach provided by the RAG has been informed by the literature review, which has surfaced the most appropriate theory and methods to analyse the problem in more detail. With my researcher hat on, I have been keen to ensure that all analysis and action is reinforced by theory, which has been introduced in the literature review. In researching ways to measure the technology acceptance of the EDM system, it was the literature review that first introduced me to the existing theory. Technology acceptance can be defined as when an end-user freely engages with technology to perform the purpose it was designed for (Teo 2011). As part of demonstrating acceptance of the technology, the end-user should use the system comprehensively, responsibly and appropriately (Schepers et al. 2005) and not seek to circumvent it. Technology acceptance is not binary, as end-users may demonstrate varying levels of acceptance, from no acceptance to full acceptance (Bhattacherjee and Sanford 2006). What I discovered during the literature review is that there are several notable theories that measure technology acceptance. Each theory appeared to be better suited under specific circumstances, for example if you are measuring the system itself, measuring the attitude towards using the system or measuring job performance. All of the relevant theories are explored further in the literature review.

3.3 Review method

The primary information source for the literature was the University of Liverpool online library, which has links to many third-party research libraries. Having such an infinite network of material helped to avoid a narrowness of the literature, as posited by Levy and Ellis (2006). Over eighty combinations of carefully crafted keyword searches took place. Searches were continually refined based on the content returned, which ensured that the most relevant literature was exposed. A review of the number of responses took place, and more precise searches were undertaken to hone the results. A significant part of the approach included skim reading literature, which is a technique that is referred to as document triage (Buchanon and Owen 2008).

On reflection, I learned much about the NHS hospitals, the genesis of the NHS structure and related technology challenges. The new knowledge subsequently influenced my practice, as I now tackle problems by searching for related literature, by studying their similarities to the current problem. What I also learned through the literature review was that I had to introduce better discipline and focus time carefully, as recommended by Peffers et al. (2007).

The core approach for this research involved conducting background research. The first area of research focused on understanding the NHS and why technological acceptance is vital to NHS sustainability, as asserted by Greenhalgh et al. (2009). Furthermore, it was also essential to focus on the context surrounding the introduction of technology solutions within the NHS. During the initial research stage, it became apparent that NHS technology initiatives often fail (Ennals 1995). What also became apparent is that there were many potential factors as to why technology acceptance fails and why IT professionals see failure as being inevitable (Goldfinch 2007). The second area of background research involved gaining an understanding of actual business problems faced by the NHS, with a specific focus on technology-based problems that would benefit from AR. Gauging the right size of the problem for a thesis was difficult, as many technology problems stemmed from specific operating practices, which in turn opened up an entirely new set of problems to study. Notwithstanding, I believe that the chosen business problem demonstrates how learning, scholarly techniques and action can combine to benefit practice. The

third area of background research involved identifying an existing theory that could be used to assess technology acceptance. Selecting the most appropriate theory proved challenging, as several theories were prevalent, such as the Technology Acceptance Model (TAM) (Davis,1989) and Task-Technology-Fit (Goodhue and Thompson 1985). Each theory had subtle differences in their application and a different focus on what actionable knowledge would follow, for example, Task-technology-fit concerns itself with how technology assists a user in performing job duties (D'Ambra et al. 2013). Despite numerous enquiries, no existing method of measuring technology acceptance in the NHS could be identified, and so this research provides a unique contribution.

The initial searches revealed a limited amount of relevant literature, making me anxious, which is not an unusual feeling amongst researchers (Bell and Waters 2014). After further discussion with my thesis supervisor, the realisation was that this research study should not just revisit existing knowledge, but can also be used to create new knowledge, meaning and understanding, principles that are at the heart of doctoral research (Sankaran et al. 2007). Renewed, the hunt for relevant literature continued, and I added an entry into my journal. On reflection, this part of the literature review was gratifying, as it provided exposure to the behavioural sciences, the study of human behaviour using scientific means (Berelson 1968). The literature also represented my first exposure to systems theory, the understanding of relationships and interconnectivity (Buckley 1967) and TAM, created by Davis (1989). A further entry in the research journal reflected that TAM appeared to be the most prevalent theory for this type of research study, with many recent studies identified. More critical thinking was required, and so I focused on the outcome, the need to understand the factors that influence technology acceptance and followed leads that would support this. I have also now adopted this approach in my practice, and always work back from the desired outcome, looking for supporting literature. The way that I have approached the literature review has also changed my practice, rather than commencing with specific terms and widening the search, I now start with broad terms and then narrow the search. I find that this new approach works better in practice. Additional searches exposed me to the world of Gamification theory. Gamification theory is the use of computer game attributes to encourage learning and behaviours in areas outside of computer gaming (Landers 2014). For

completeness, the same searches were conducted using the public internet, which returned vast amounts of material. As the internet is not a reliable academic source (Vedder and Wachbroit 2003), it was only appropriate to include a limited amount of material from this source, which was limited to a small number of press releases from reputable sources, such as the British Broadcasting Corporation (BBC). The press releases add context and explanation to the current NHS operating environment, providing valuable accounts of technology acceptance, how technology is introduced in the NHS and the impact of technology failure. An understanding of such material is essential for this research, as it demonstrates public opinion and the importance of technology. An entry was added to my research journal to include press releases, which was agreed by my thesis supervisor.

3.4 Assessing technology acceptance

While theories that measure, explain and predict technology acceptance have been around since the 1970s, such as the System Utilisation theory (Schultz and Slevin 1975), no benchmark of what good acceptance looks like could be found for the NHS. The business problem in this research focuses on the acceptance of a new EDM system as an electronic patient record. From my perspective, good technology acceptance would be to use the technology solution throughout the day as the reference point for patient information while caring for the patient. In essence, the technology should support the care function and staff interaction and not hinder it (Peled et al. 2009). There would be no circumvention of the system, no printing or manual note-taking. Ultimately, success in my practice would come from staff freely engaging directly with the system, and technology perception development would help (Agarwal and Prasad 1998). Understanding technology acceptance is vital as such technology solutions are expected to help staff perform their job activities more effectively and represent substantial financial investments that have the potential to deliver benefit, which is a complicated matter (Dillon 2001).

3.4.1 Technology Acceptance Model (TAM)

First published in 1989, the Davis (1989) TAM theory has established itself as a highly regarded methodology, as its empirical research provides extensive support for the theory across multiple IT contexts (Gefen and Larsen 2017). The purpose of TAM was to understand why users accept or reject technology innovation. Davis (1989) pioneered a way to predict and measure an end-user's intention to use the system. TAM theory builds on previous Systems theories of the time, such as the Schultz and Slevin (1975) System Utilisation theory and TAM now forms an integral part of Systems theory. Information Systems theory as it is now known represents an extensive collection of methods used to understand technology use, acceptance, rejection and satisfaction. The theory has been developing since the 1960s when the computer became prevalent (Dwivedi et al. 2012). The TAM stemmed from prior research that created a validated link between Information Systems theory and the Theory of Reasoned Action (TRA). The TRA is a psychological, behavioural theory developed in the 1980s that seeks to understand a person's voluntary behaviour (Ajzen and Fishbein 1980). One such use case in the USA was to understand peoples voting preferences. TRA was later complemented by the Theory of Planned Behaviour (TPB), as asserted by Holden and Karsh (2010), which considers volitional control. By combining these theories, Davis (1989) created a way to predict an end-user's attitude towards using technology (Yi et al. 2007). It is worth noting that a pre-cursor to the TAM conceptual model first featured in the Davis (1985) thesis for the Massachusetts Institute of Technology. The Davis (1989) TAM model demonstrated through empirical research that two constructs have a significant positive effect on the end-user's intention to use the system, which in turn drives actual system use (Marangunic and Granic 2015). The two most dominant constructs are Perceived usefulness, the system's ability to aid one's job function and Perceived ease of use, the limited physical and mental effort required to use the technology. There is an assertion that above all else, it is these two constructs that are most important in determining actual system use (Davis 1989; Szajna 1996). The TAM model also demonstrated that there is a positive effect between Perceived ease of use and Perceived usefulness (Szajna 1996). Figure 3.4.1 depicts TAM construct relationships.

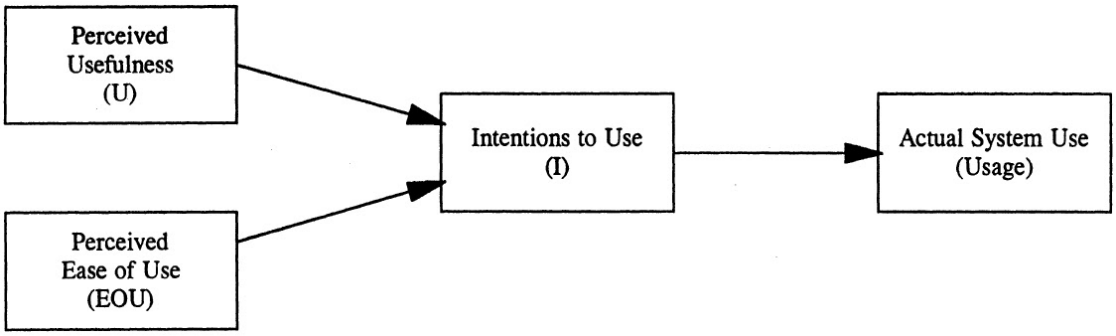

Figure 3.4.1 TAM relationships (Davis 1989)

A fundamental assertion is that TAM provides theoretical value and provides actionable knowledge with high practical value (Davis,1989). Vendors are able to use this information to design better features and be more competitive (Young 2010). System managers could also benefit from using TAM, as it offers a more natural way to evaluate a vendor's offerings (Davins 1989). Davis (1989), through the creation of TAM, has created a reliable way of assessing technology acceptance, which has become the dominant methodology for its investigation (Hu et al. 1999).

Having performed exhaustive research seeking out relevant methodologies to understand technology acceptance, it appears that the development of technology systems theories has slowed, with the majority of the underlying theory created before the millennium (Dwivedi et al. 2012). While the literature review revealed an overwhelming number of variations and extensions based on the theories created in the 1980s, especially TAM, the literature review did not reveal any newer theories for assessing technology acceptance. Chuttur (2009) describes TAM as being very popular for assessing technology acceptance and asserts that future researchers will continue to exploit the strengths of TAM for technology acceptance by extending it further, which this research demonstrates.

3.4.2 TAM2

The versatility of TAM was further demonstrated in the year 2000, whereby TAM theory became enhanced and expanded to form “extended TAM” or “TAM2” (Venkatesh and Davis 2000). TAM2 benefited from the combined efforts of two experienced information systems researchers, who bring a more in-depth and richer understanding of the factors that influence technology acceptance, as it remains a complex and vital phenomenon (Davis and Venkatesh 2000). A significant problem for business is that there are IT systems out there that are under-utilised. In simple terms, the end-users are choosing not to use these systems, which leads to waste. Waste, in this case, is a low return on investment in the technology and is also the loss in productivity gains made through the use of technology. Such an understanding is linked directly to the business problem experienced in my practice. For over a decade, TAM has consistently explained the variance between the different perceptions, however, there is a compelling need to expand the Davis (1989) model further by adding new constructs Davis and Venkatesh 2000). The extended TAM model reinforced the findings of the original TAM study and upholds Perceived usefulness and Perceived ease as the critical determinants of system use (Davis 1989). While the original TAM constructs, Perceived ease of use and Perceived usefulness remain at the heart of the TAM2 model, these constructs are joined by several additional constructs that span social influences via a subjective norm (Ozag and Duguma 2004). The subjective norm is the belief of the end-user that their peers would want them to perform or not to perform the behaviour (Davis and Venkatesh 2000). Subjective norm adds an entirely new dimension to the original TAM model as peer pressure was not previously considered. Davis and Venkatesh (2000) assert that pressure from colleagues has a significant effect on usage intentions, which was not possible to reveal using the original TAM but the effects of peer pressure are now visible using TAM2. As part of the significant extension to TAM, a construct representing voluntariness, which is the free use of the system in non-mandatory circumstances (Tang and Chen 2011) has also been added to distinguish between mandatory use and voluntary system use. While the Voluntariness construct is useful, it will most likely have a low value in the NHS, as keeping a record (clinical noting) is mandatory. A further construct measuring the prestige (Image) associated with being able to access systems (Calisir et al. 2014) can

also be measured. TAM2 has been designed to offer greater insight where the use of technology is optional and where staff have a choice of using different systems. Furthermore, the extended model measures the effects of job relevance, along with results demonstrability, providing the ability to understand and convey the benefits of the system. The majority of these new constructs combined with others are of extreme benefit to this research study, as new constructs such as Subjective norm can be readily associated with the NHS operating environment, providing more meaningful measures, as determined by the RAG. The RAG also determined that several other constructs were vital to the NHS, which include the Output quality construct, which is understanding what the system produces (Chismar and Wiley-Patton 2003) and the Image construct, a measure of personal importance. Figure 3.4.2 below depicts the relationships between the constructs of the TAM2 model.

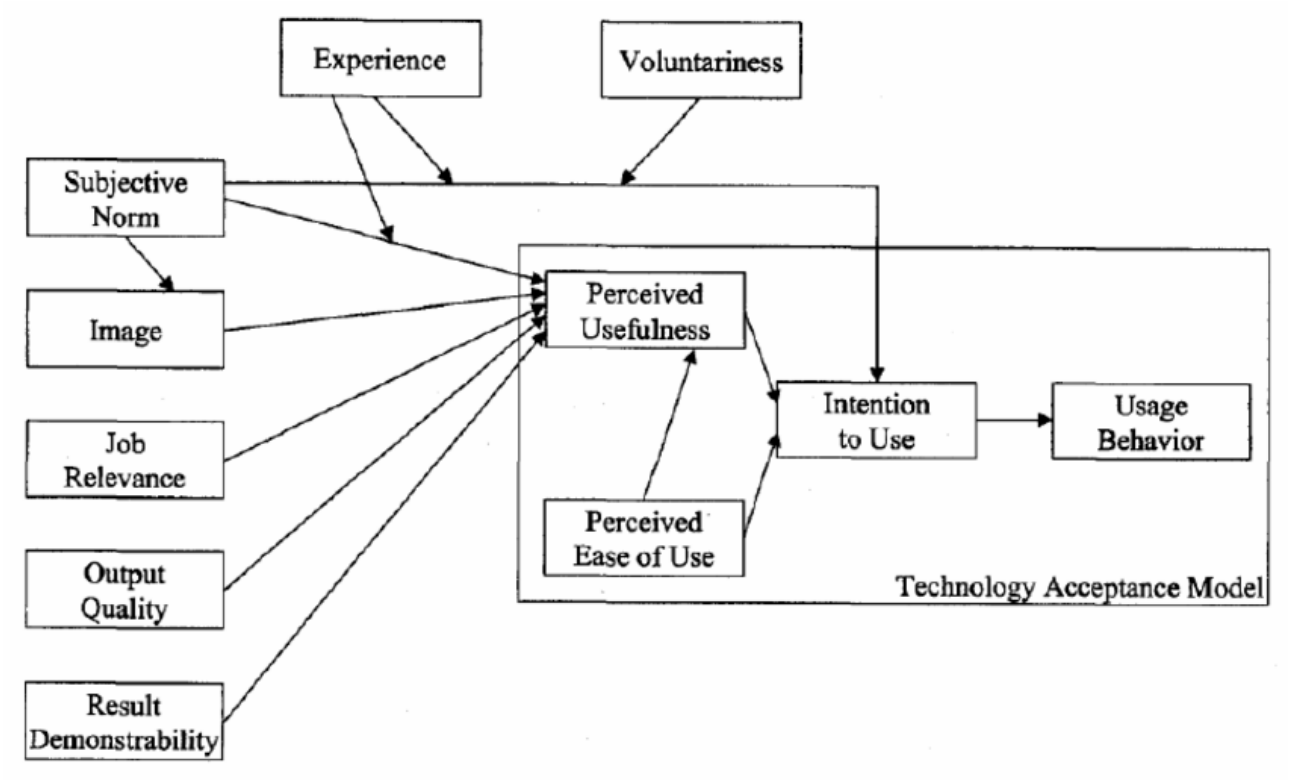

Figure 3.4.2 Venkatesh and Davis (2000) TAM2 model

3.4.3 TAM3

In 2008, the TAM3 model emerged as a further expansion of TAM theory which advances on TAM2 (Venkatesh and Bala 2008). While Perceived ease of use and Perceived usefulness remain at the heart of every evolution of TAM, the TAM3 model adapts TAM theory to support decisions. Venkatesh and Bala (2008) assert that while there is significant progress in understanding the acceptance of technology by system users, technology projects are failing due to low adoption rates. In order to solve this business problem, it was essential to understand what informed decisions management can take to avoid technology acceptance issues. Therefore, TAM3 has been specifically designed to focus on a theory that is referred to as Interventions (Venkatesh 2006). The Interventions concept came from a study relating to information systems decision support and is based on the belief that there are organisational and managerial support activities that can be undertaken to improve technology acceptance (Venkatesh 2006). The pursuit of interventions led to the creation of TAM3, and there is an explicit acknowledgement that the general pattern of relationships in TAM and TAM2 still hold (Venkatesh and Bala 2008). TAM3, however, embodies a deeper understanding and a willingness to guide interventions through the introduction of new variables, such as experience, which is believed to play a significant part in technology acceptance, allowing the moderation of the core Perceived ease of use and Perceived usefulness constructs. With TAM3, Venkatesh and Bala (2008) assert that the moderation of the impact of behavioural intention and the moderation of the impact of computer anxiety is possible. TAM3 represents a framework for managers, which enable them to act before, during and after technology implementations, enabling systematic improvements to be developed, used and evaluated (Huang, Martin-Taylor 2012). It is the capability to intervene that makes this theory align with the business problem and research goals. The overall assertion is that TAM3 provides a more in-depth analysis and understanding, which leads to actionable knowledge. Further literature searches did not reveal any other official expansions to TAM theory by its creators since 2008.

On reflection, despite originating thirty or so years ago, TAM is still the most widely used method for determining and predicting technology acceptance

(Holden and Karsh 2010). What TAM2 and TAM3 have demonstrated is that TAM has a strong theoretical foundation, which allows the creation of flexible models that can be used to provide reliable predictions of end-user intention (Premkumar and Bhattacherjee 2008). The real value of TAM comes from its versatility, the ability for researchers to extend it to provide answers to specific technology challenges, which can be evidenced. My research into TAM has revealed that healthcare researchers often extend TAM for this purpose, with an excellent example on healthcare electronic learning provided by Chow et al. (2012). Furthermore, after an extensive study of technology acceptance by nurses, Strudwick (2015) asserts that extending TAM with additional variables leads to a better understanding of a nurse's intention to use technology.

One of the main benefits of TAM is that it represents a robust way of understanding technology acceptance, which can be extended by the researcher to gain more insight (Rose and Straub 1998). As such, there have been many TAM studies and many extensions to TAM, all of which target one or more factors that impact attitudes towards technology acceptance. One such relevant extension to the TAM methodology is the Yoon (2016) addition of the Perceived interactivity construct. The Perceived interactivity construct was initially introduced by Mathieson et al. (1991), who assert that the quality (end-user experience) of the interaction between the end-user and the system is also a determinant factor. The research of Yoon (2016) builds on this theory and determines that perceived interactivity, a construct based on speed, content and convenience of the system has a positive effect on user attitude, which also then has a positive effect on the intention to use the system. Such a construct offers benefit with this research as there is a belief within the RAG that system access should be swift and the most relevant content readily accessible for healthcare staff. Furthermore, there is an expectation that the system should be convenient to use, and readily available wherever there are patients and clinicians. Figure 3.4.3 below depicts the Yoon (2013) extended TAM construct relationships.

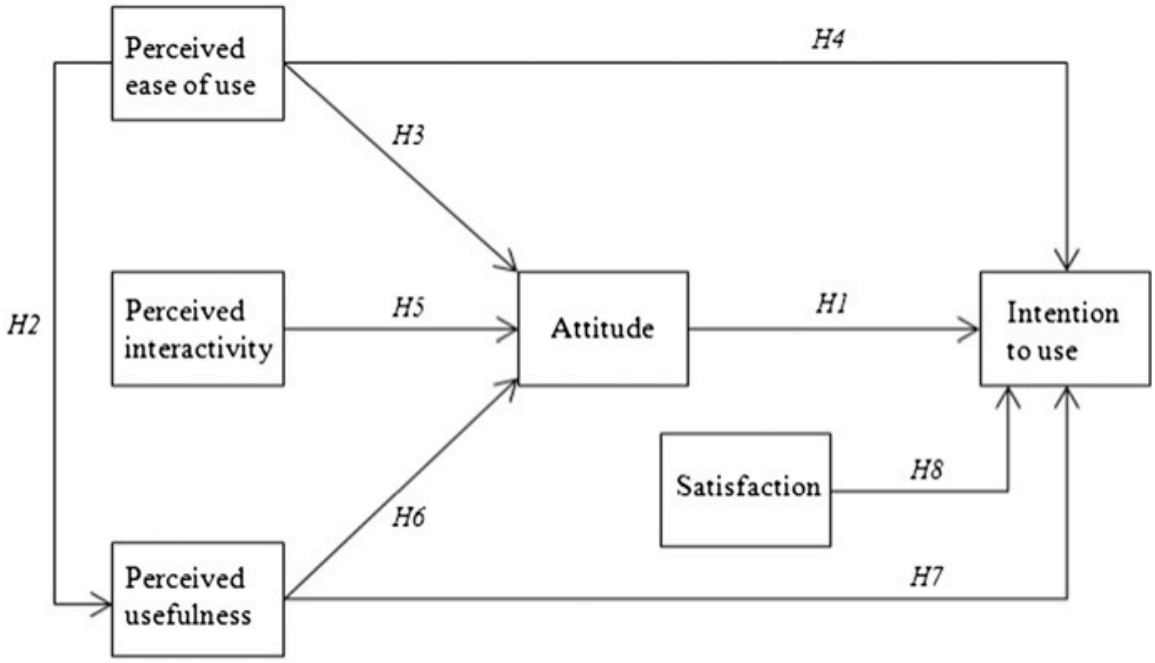

Figure 3.4.3 Yoon (2016) Perceived interactivity TAM extension

A further relevant extension to TAM comes from the work of Amoako-Gyampah and Salam (2004), who re-examine the effects of training and communication. The authors uphold the theory that end-user training has a positive effect on technology acceptance. The researchers demonstrated through the use of a Training construct that training has a positive effect on Perceived ease of use, and in turn, has a more positive effect on the end-user's intention to use the system. The understanding that training has a positive effect on technology acceptance is not new knowledge. Such a realisation initially stems from the Systems theory approach developed by the TAM2 founding members Venkatesh and Davis (1996). The research demonstrated that developing training mechanisms to improve end-user self-efficacy increased the likelihood of gaining technology acceptance, as asserted by Amoako-Gyampah and Salam (2004); Venkatesh and Davis (1996). Figure 3.4.4 depicts the relationships from the Amoako-Gyampah and Salam (2004) model. The effects of training on system acceptance were also later re-tested and confirmed by Marshall et al. (2008). While reflecting on the impact of training on the business problem, end-user training formed a significant part of the implementation project for the NHS hospitals. The effect of the training was untested and therefore the benefit unknown. As such, the inclusion of the Training construct is a necessary measure in this research study.

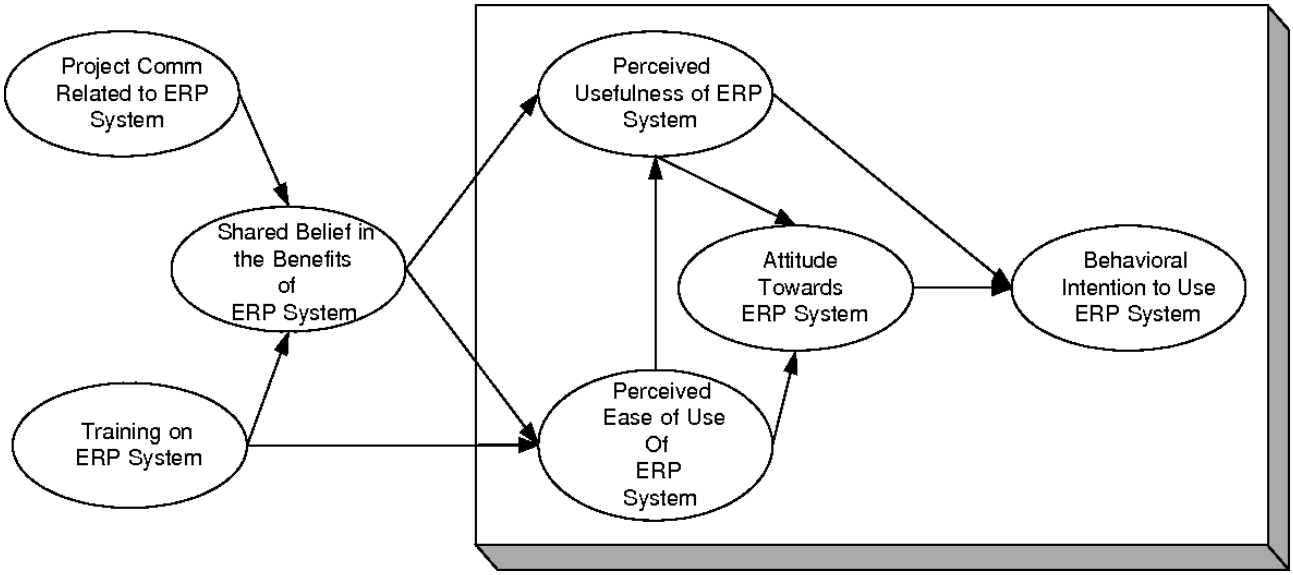

Figure 3.4.4 Amoako-Gyampah and Salam (2004) extended TAM model

A final relevant extended TAM study comes from Ku (2009), which specifically hones in on the effect that a Perceived resources construct has on end-user attitude and therefore, the intention to use the system. The researcher also determines that Perceived resources has a positive effect on Perceived ease of use. In simple terms, greater access to the required resources makes the system readily available and thus more convenient to use (Mathieson et al. 2001). Figure 3.4.5 depicts the relationships in this extended model. In this case, Perceived resources are enablers, such as access to computers and printers. Based on insight from the RAG, the Perceived resources construct is of particular importance within the NHS hospitals. In the NHS hospitals, not every staff member has the use of a dedicated computer. Administrative jobs, such as medical secretaries and ward clerks require constant computer use, and so these roles have allocated desks with a dedicated computer and telephone. Computers in clinical areas such as on the wards and in clinic rooms are pooled and used by several people each shift. There are three shifts eight hour shifts every twenty-four hours. The majority of clinical staff do not have a dedicated desk, computer or telephone and therefore share. As such, these staff work in highly contended areas.

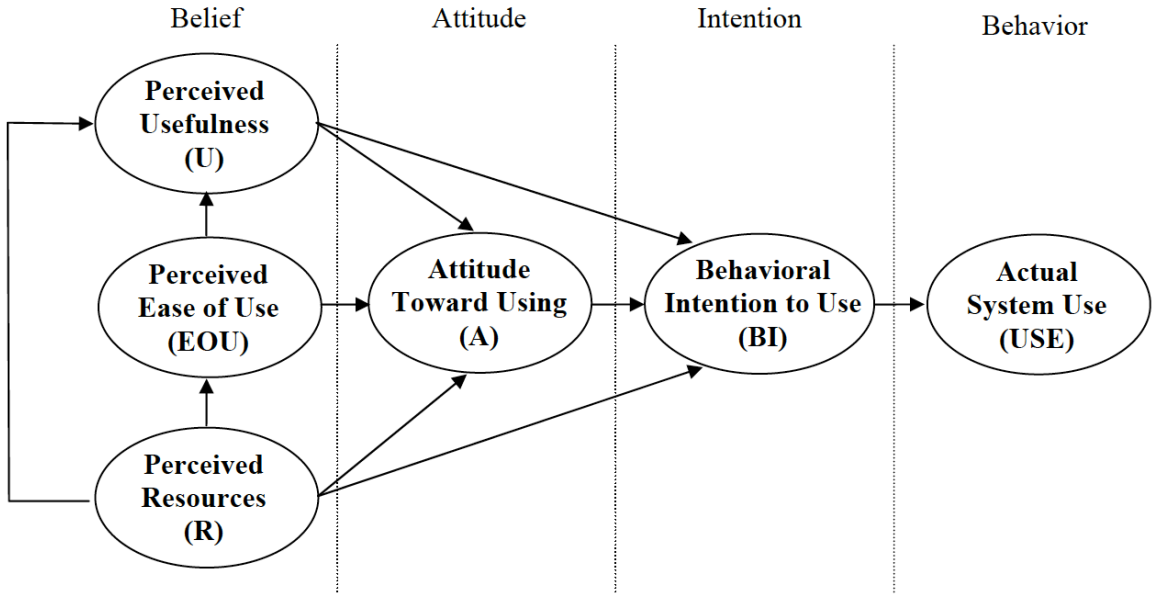

Figure 3.4.5 Ku (2009) Extended TAM model

The last 30 years have resulted in many TAM related studies. Each TAM study is an extension of TAM and as such are subtly different. Researchers create bespoke TAM models to evaluate new constructs or new combinations of previously tested constructs, a technique used in this research study. Such studies have led to the creation of new models, which are in-turn extended by future researchers, which is my intention for the TAM model created in this research. Statistical analysis is used to test the effect on the end-user's intention to use the system. Sometimes new constructs are able to demonstrate a positive effect, and if not, the construct is removed from the model. Most of the extended TAM studies lead to the creation of specific knowledge, delivering insight into a software application or to a specific industry, as asserted by Davis (1985). One thing worth noting is that all of the TAM studies that I found relied solely on quantitative methods. What makes this TAM research different is that it also leverages qualitative methods and blends the findings with the quantitative analysis to form a more in-depth understanding of the business problem. Combining both analytical methods and applying them to my business problem will provide me with actionable knowledge.

When reviewing extended TAM studies, Wang and Goh (2017) provide a useful example of how TAM and TAM2 can be used as a base methodology and extended to gain insight into a specific industry or application. Wang and Goh

(2017) combine the TAM Perceived ease of use and Perceived usefulness constructs with a new construct, Perceived enjoyment. In the resultant conceptual model, Perceived enjoyment is accepted as being determinant in sustained online gaming. TAM is widely used to assess user acceptance in the gaming industry, with over fifty TAM related studies being created in twelve years, as asserted by Wang and Goh (2017). Similarly, Yoon (2016) further demonstrates how the principles of TAM can be used to understand factors that impact the attitudes toward using a mobile academic library application. In this case, the original TAM model is extended by creating a Perceived interactivity construct, a measure of speed and content. The construct was tested and demonstrated a positive effect on the intention to use the system, however, Yoon (2016) concludes that such a study is limited as it does not include a way to measure individual differences, such as computing self-efficacy. Reviewing existing TAM literature brings specific insight into solving my business problem as it demonstrates how to analyse real-life technology phenomenon, how TAM can be applied successfully, and how TAM can be expanded to form new theoretical frameworks. All of this knowledge is vital for this research and my practice. What has changed in my practice is that I can now see how an existing theory can be adapted to suit subtly different problems rather than discarded.

3.5 Other related theories

The literature review revealed several other widely adopted theories used to understand the broad area of technology acceptance. The key research objectives are to understand the factors that influence technology acceptance, identify action to improve acceptance of the EDM system and to promote the on-going use of the system. In this regard, understanding the individual's acceptance of the EDM system, which is a task related system is paramount. The related theories were not as well suited as TAM to achieving the research goals, as TAM is considered to be a robust and powerful method, which provides an accurate measure of an individual's technology acceptance, as asserted by Hsiao and Yang (2011). The main limitation of the other methods is that they were designed to measure something different, which is explained in more detail, such as organisation benefits.

It is worth noting that TAM does have its limitations. Owing to being created prior to the emergence of the internet, TAM needs to be extended to include constructs such as trust and innovation to prove useful when measuring the acceptance of e-commence systems, as asserted by Hsiao and Yang (2011). In fairness, there is also a need for IS researchers to play a central role in creating effective methodologies for other fast-moving technologies such as Social media, as asserted by Aral et al. (2013). Despite the fact that TAM continues to be extended and implemented successfully, its use with healthcare technology is limited (Kim and Park 2012). Such an assertion is in keeping with my observations, in that there are few TAM related studies for healthcare and I have been unable to find any that specifically focus on technology acceptance in NHS hospitals.

3.5.1 Gamification Theory

Gamification theory is the use of gaming principles in non-gaming situations, as asserted by Huotari and Hamari (2012). Gamification is a tool used to encourage motivation and wanted behaviour, as asserted by Stieglitz et al. (2017); Aaron (2017). The theory itself does not provide a method of assessing factors that influence technology acceptance, instead it provides powerful insight in how you can improve productivity and desirable outcomes. The theory is implemented by providing simple but effective digital based rewards, including gaining a level, points, trophy or medal, appealing to hedonic motivation characteristics (Elderen and van der Stappen 2019). The theory works best when there are no underlying barriers to acceptance and it is simply more usage that is required. What is really interesting about this theory is that it sits really well with AR, potentially forming part of an Act stage, where measurable outcomes are required. While not directly applicable to this research, as it is the attitude towards technology that is being assessed, there is an opportunity to combine this theory with other theories, such as Task-Technology Fit to introduce wanted behaviours, as demonstrated by Vanduhe et al. (2020).

3.5.2 The Information Systems Success Model (ISSM)

ISSM is a model created by DeLone and McLean (1992) to identify the factors that contribute to the information systems success. The ISSM theory is possibly flawed, as it attempts to combine process with casual explanations, as asserted by Seddon (1997). An updated ISSM was released which extends and modernises the theory (DeLeon and McLean 2002; Petter et al. 2008) such that it can be used a predictor of net benefits, which are the benefits that the organisation will receive. The updated ISSM is widely used and provides a way of measuring how successful a system is in terms of end-user satisfaction. As this research is predicated on understanding the factors that influence technology acceptance, it does not fit as well as TAM. Notwithstanding, there are examples where ISSM is combined with TAM to provide a holistic view of technology acceptance and benefits, as demonstrated by Adeyemi and Issa (2020).

3.5.3 Task-Technology Fit (TTF)

TTF was created by Goodhue and Thompson (1985) and provides a predictable measure of the relationship between technology and individual job performance when using technology, as asserted by Tripathi and Jigeesh (2015). TTF performs well when comparing expected benefits with the realised benefits, as demonstrated by Lepanto et al. (2011). While not applicable in the first few AR cycles being implemented in this research, being able to accurately measure job performance as a future AR cycle would be beneficial to ensure that the hospitals realise the benefits that were set out in the business case used to justify the purchase.

3.5.4 Theory of Planned Behavior (TPB)

TPB links beliefs with behaviour (Ajzen 1985) and is one of the most influential theories in predicting behaviour (Pavlou and Fygenson 2006). While TPB was not explicitly created to assess technology acceptance, it has merit, as it encourages the gathering of more specific information (Mathieson 1991). TPB provides a link between attitude and behavior (Kim and Park 2012), a measure of behavioral intention, the perceived control of an end-user (Lai 2017). Such insight is useful but extremely limiting when trying to establish multiple factors that influence acceptance, such as with this research.

3.6 Other factors impacting Technology acceptance

Beyond the findings of the original TAM model and the effects of Perceived usefulness and Perceived ease of use, many other factors can influence the attitudes of staff using task related technology in the NHS and successful IT implementations. Jeffcott (1999) has studied NHS IT projects and asserts that healthcare is at the forefront of the IT revolution. The revolution is seen to bring operating efficiencies through the use of IT and benefits to patients, however little progress has been made, and there is much paper still in use and sharing data remains difficult Jeffcott (1999). The critical differences between public sector projects and private sector projects boil down to public sector projects having greater size, complexity, uniqueness and cost (Jeffcott 1999). All of these differences represent essential variables that can be demonstrated in a hypothetical model, whereby combinations of the variables determine the viability and possibility of successful outcomes. Factors such as poor project management, blame and a culture of saving face rather than admitting defeat, often throwing good money after bad directly contribute to failure (Jeffcott 1999). There are more failures with NHS healthcare IT projects than successes (Jeffcott 1999) and technology acceptance fails when there is a lack of user participation (Campion-Awwad et al. 2014). There is an unhealthy dysfunctional culture between the developers of IT systems and the system users, with a reluctance to keep stakeholders apprised of technical and financial concerns (Jeffcott 1999). This minimal approach to communication leads to distrust and isolation of the project team, with the overall impact being limited technology acceptance, resulting in a reduced chance of success. Jeffcott (1999) provides much insight

into technology acceptance such as the need to involve the end-users of the system in the design and implementation, effective stakeholder relations and end-user involvement at all stages. In addition to stakeholder involvement, practitioners are advised to ensure appropriate consideration for end-user training and communications (Campion-Awwad et al. 2014). Specifically, in the NHS, one TAM related study indicated that GP's would not use the system if it resulted in a patient consultation taking more than five additional minutes (Schaik et al. 2007).

Training and the influence that training has on the intention to use the system is also a significant factor that influences technology acceptance (Amoako-Gyampah and Salam 2004). Through empirical research, the Training construct was found to have a positive effect on Perceived ease of use, which in turn had a positive effect on Intention to use the system (Amoako-Gyampah and Salam 2004). The positive effects of training on system use are further endorsed by Amoroso and Cheney (1991), who assert that training, experience and motivation all have a positive effect on attitude towards using and frequency of system use. User motivation is also considered to be a factor that influences system adoption, as asserted by Davis (1985). There is a need not to underplay the effects of intrinsic motivation, and while this was not a consideration in the Davis (1989) TAM, it is a significant finding by Carpenter and Buday (2007). There is also a link between motivation and the concept of the subjective norm. The subjective norm is the influence that colleagues and those held in high esteem have on behaviour. The TAM2 model extends TAM by including the subjective norm. It is worth noting that friends and family also form part of the subjective norm, playing a significant part in technology acceptance, as asserted by Brown and Venkatesh (2005).

3.7 Conceptual Model: Modelling, the Proposed Model & Literature Review of each Concept

Understanding end-user behaviour, the factors that influence technology acceptance, and what makes system implementation successful has perplexed scholars and business folk alike for decades (Delone and MacLean 2005). The waste and loss of value associated with poorly used IT systems is substantial (Venkatesh and Davis 2000).

Using the collective experience of the RAG, it was determined that several factors were impacting the individual acceptance of the EDM system. Some of the factors proposed included training, availability of equipment and speed. The factors were shortlisted and with my research role, I set about the task of researching these factors, specifically looking for TAM related studies that demonstrated the factors. As a researcher, I was keen to ensure that I leveraged existing knowledge to support the claims of the RAG. The thinking was that by adopting TAM, the knowledge created from this research could also benefit others and be used to deliver improvements that would increase user acceptance and usage of new systems across other NHS hospitals. Extending the use of this knowledge to others is the very essence of a DBA study (Barehame et al. 2000).

As IT systems have been introduced and studied since the 1960s (Comin and Hobijn 2004), the theory and models have significantly advanced. Specifically, this is the area referred to as Systems theory. By way of example, looking at TAM theory, there have been no less than three iterations of TAM over twenty years, with each iteration advancing the theory using robust research. The original TAM theory was created in 1989 (Davis 1989), TAM2 introduced several new constructs in 2000 (Venkatesh and Davis 2000) and TAM3 introduced interventions in 2008 (Venkatesh and Bala 2008). TAM methodology is the single most widely adopted method used to understand technology acceptance, which is due to its simplicity (Nath and Kapoor 2013). TAM is also widely used to study technology acceptance in healthcare (Holden and Karsh 2010). Using a seven-point Likert-type scale, Davis (1989) surveyed organisations and proved that perceived usefulness, and perceived ease of use are the two most dominant factors that have a positive effect on technology acceptance. My research seeks

to extend TAM theory further by using it to understand what other factors also influence acceptance in NHS hospitals so that I can plan action to solve the business problem.

3.7.1 Building the Conceptual Model

The resulting conceptual model developed by this research embodies the observations, experiences and spirit of the RAG. Rather than re-invent the wheel and attempt to develop an entirely new methodology, the approach for this study has been to accept and extend TAM to immortalise the RAG experience, which is in keeping with other healthcare technology-related studies (Holden and Karsh 2010). TAM has been determined as the best fit for the business problem, as it focuses explicitly on technology acceptance and leads to the creation of interventions (Venkatesh and Bala 2008), which is actionable knowledge. As such, the selection of TAM as the most appropriate theory for this thesis was a significant decision, which was approved by my thesis supervisor. A primary outcome of this research study is the creation of an extended TAM model that can be shared with public managers and researchers, so that they can also accurately predict technology acceptance in NHS hospitals.

Based on the experience and reflection of the RAG, a conceptual model for the NHS hospitals has been created and is introduced in the next section. Like the majority of extended TAM studies, this research upholds the standard principles of TAM relating to Perceived usefulness and Perceived ease of use and also benefits from the other extended TAM models by leveraging their tested constructs.

3.7.2 The Proposed Conceptual Model

A crucial part of this research study led to the creation of an extended TAM conceptual model for the NHS hospitals, immortalising the experience of the RAG. The conceptual model represented one of the best learning experiences for me when conducting this research, and the model is a tangible outcome that can be extended by others. Creating the model provided a rewarding feeling, as I was able to demonstrate through research, I could extend the well-respected Davis (1989) TAM theory. In doing so, it became evident that a researcher does not just master the scientific process but also needs to be creative. Exploiting opportunities to build on existing theory and concepts as opposed to starting from scratch is an area where my practice has now changed. The conceptual model provided me with an opportunity to demonstrate my experience as a scholarly practitioner and to leverage the knowledge of the RAG, which is permanently embodied in the constructs. The outcome was a conceptual model founded on accepted theory. The conceptual model indicates the causal relationships among the constructs in the model, as depicted in Figure 3.7.2 below. Quantitative analysis was used to gather the required data to test the conceptual model through the use of a survey instrument, which will be used to establish causal relationships. The conceptual model is tested using structural equation modelling.

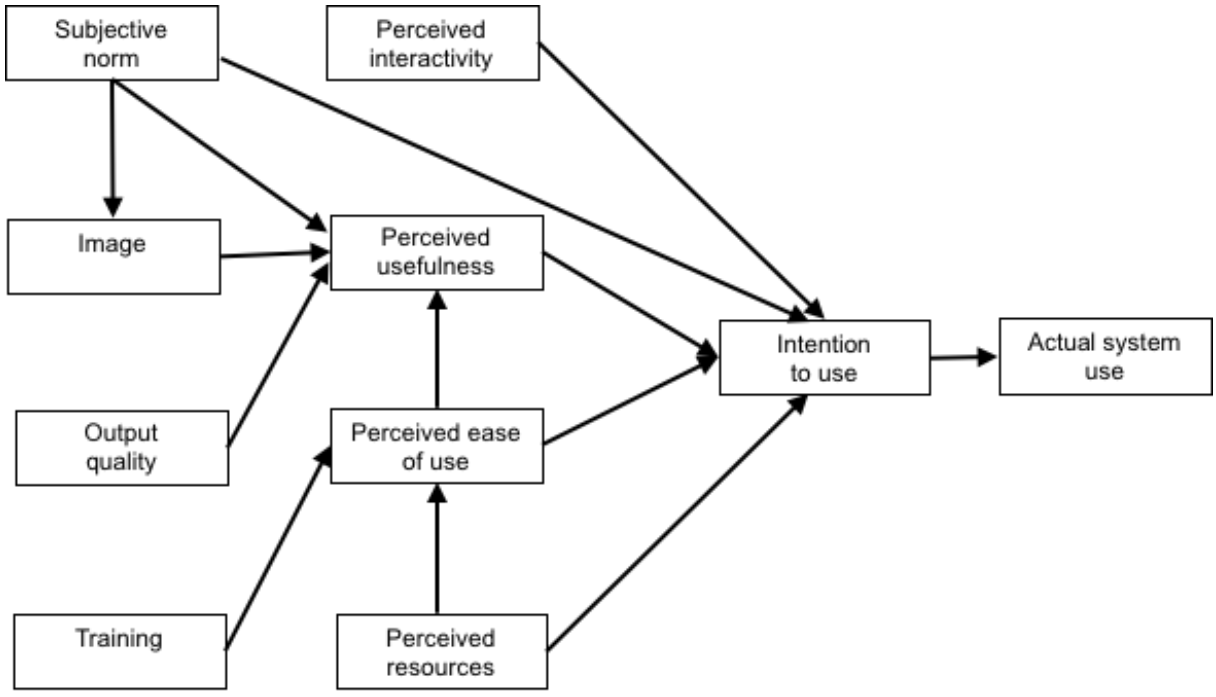

Figure 3.7.2 Proposed conceptual model

3.7.3 Choosing Already Validated Constructs

The Davis (1989) TAM has provided a theoretical scaffolding to predict intentions accurately and to determine technology acceptance (Yousafzai et al. 2007). Like all scaffolding, TAM can be adapted to suit specific needs, which makes TAM a formidable and influential research model (Chau 1996). As such, there are many extended TAM studies with a wide range of validated constructs, some of which are included in this chapter and feature prominently in the conceptual model. Using validated constructs provides assurance for the conceptual model, improving its overall accuracy. Being able to measure the state of technology acceptance for my practice was a crucial factor when deciding to adopt TAM above all other methodologies. By using the flexibility of TAM and extending it, the intention is to plan specific action to solve the business problem identified and to create transferable knowledge that determines the factors that influence technology acceptance within the NHS hospitals. I intend to use this knowledge in my practice for future technology projects and to share it as a framework for other researchers to build on, whereby the additional constructs can be added and some of the constructs removed as required. In addition to using the Davis (1989) core constructs, the conceptual model also benefits from the findings of other technology researchers, who have also chosen to extend TAM to help them in their practice. Much research was undertaken to match the understanding and observations of the RAG with constructs tested by other researchers who have extended TAM. The final validated model demonstrates what the RAG believes to be the most relevant factors that influence the use of technology in the NHS hospitals. All constructs in the conceptual model are from prior research as follows: -

- Constructs Perceived ease of use, Perceived usefulness and Intention to use along with their tested relationships are accepted from the Davis (1989) TAM model and the Venkatesh and Davis (2000) TAM2 model. The RAG accepted this construct as it is fundamental to the methodology.
- Constructs Subjective norm, Image and Output quality, along with their tested relationships, are accepted from the Venkatesh and Davis (2000) TAM2 model. The RAG posits these constructs as they have been observed in the workplace.

- Construct Perceived interactivity, and its tested relationship with Perceived usefulness, is accepted from the Yoon (2016) extended TAM model. The RAG believed that the ability for an end-user to interact with the system is paramount to its acceptance. The Yoon (2016) model demonstrates a direct relationship between Perceived interactivity and an end-user's attitude towards using the system, in turn Attitude then has a direct effect on the end-user's intention to use the system (Intention to use construct). In the conceptual model, this relationship is reflected differently, as the RAG believe that an end-user's ability to interact effectively with the system (Perceived Interactivity construct) has a direct effect on the end-user's intention to use the system (Intention to use construct). Basically, what the RAG has experienced is that if the system interaction is poor, the end-user will simply not use the system, irrespective of what they think about the system and its benefits and purpose.
- Construct Perceived resources and its tested relationships with Intention to use and Perceived ease of use is accepted from the Ku (2009) extended TAM model. The RAG observed that the staff that use the system most were those that had unfettered access to computers.
- Construct Training, and its tested relationship with Perceived ease of use is accepted from the Amoako-Gyampah and Salam (2004) extended TAM model. The RAG strongly believed that appropriate system training leads to robust usage of the system.

3.7.4 Literature Review of each Conceptual Model's Constructs

The conceptual model created leverages the experiences of the RAG, which led to tested constructs from prior research studies being adopted. As demonstrated by many of the extended TAM studies, TAM can be used to explore the different relationships that exist between factors that influence technology acceptance (Moon and Kim 2001). Some of these factors may be industry, staff group or technology-specific. Other factors may be organisational or administrative, such as subjective norm. The constructs selected for the conceptual model, along with the origin of the construct are introduced as follows: -

3.7.4.1 Perceived ease of use

Perceived ease of use was one of the two original theoretical constructs tested in the Davis (1989) TAM theory and features in all subsequent TAM research. The construct is used to reflect the fact that using the technology is effortless, both in terms of physical and mental effort (Davis 1989). The original definition of Perceived ease of use as provided by Davis (1989:320) is "the degree to which a person believes that using a particular system would be free of effort". This understanding was formulated by Davis (1989), who leveraged prior research on self-efficacy by Bandura (1982) as cited in Davis (1989). The definition of self-efficacy is defined by Bandura (1982:122) as being "judgments of how well one can execute courses of action required to deal with prospective situations". This research proposes the same definition for Perceived ease of use as Davis (1989) and further promotes the underlying theory. The use of the Perceived ease of use construct plays a prominent part in this research and all other TAM related studies. Perceived ease of use has been tested and demonstrates a positive effect on Perceived usefulness, as discovered in the original Davis (1989) study and confirmed with the Venkatesh and Davis (2000) TAM2 study, along with subsequent TAM studies.

3.7.4.2 Perceived usefulness

Perceived usefulness is the second of the two original theoretical constructs tested in the Davis (1989) TAM theory. The construct is used to reflect the fact the technology adds value to a job function. Being useful is a reasonable expectation for a modern tool. The original definition of Perceived usefulness as provided by Davis (1989:320) is "the degree to which a person believes that using a particular system would enhance his or her job performance". This understanding was formed by Davis who leveraged prior research from other noteworthy Systems theory researchers including Schultz and Slevin (1975) as cited in Davis (1989) and Robey (1979) as cited in Davis (1989) who link job performance with system utilisation. This research upholds the same definition and promotes the underlying theory. The use of the Perceived usefulness construct plays a prominent part in this research and all other TAM related studies.

3.7.4.3 Subjective norm

Subjective norm is a construct first introduced in the Venkatesh and Davis (2000) TAM2 study. This Subjective norm construct is used to demonstrate that social influences have a positive effect on the intention to use the system. To determine this, researchers leveraged prior tested theory from aligned sciences such as the Theory of Reasoned Action as pioneered by Fishbein and Ajzen (1975) and the Theory of Planned Behaviour (Azjen 1991), which superseded it. The researchers identified subjective norm as being a direct determinant of behavioural intention. In simplistic terms, when a crucial referent, such as a manager or a colleague, recommends a course of action, the action is undertaken even if it is not the person's preferred action. Subjective norm therefore has a powerful effect. Another determinant is that subjective norm has limited effect in situations where system usage is voluntary (Hartwick and Barki 1994). In the case of the NHS hospitals, making informed decisions by using the patient record is mandatory and not voluntary and so falls within the scope of the Subjective norm construct. As with the TAM2 model, Venkatesh and Davis (2000) also assert that Subjective norm has a positive effect on Image. Image is the elevated status and referent power that one gets from within the group by using innovations, as asserted by French and Raven (1959). The effect on Image is through the identification effect.

3.7.4.4 Perceived Resources

The Perceived resources construct was first proposed by Mathieson et al. (2001), and appears in extended TAM models, such as Cheng-Hsin (2009). Perceived resources embody the belief that an individual has the personal and organisational resources needed to use the system. The construct stems from the Theory of Planned Behaviour pioneered by Azjen (1991), as asserted by Mathieson et al. (2001). Resources can be anything that is required to use the system, such as a computer, chair, desk, printer. In the NHS, for clinical staff, sought after resources would be a desk with a computer and telephone, possibly with a nearby printer. The Perceived resources construct has significant value in the NHS hospitals, as resources can be scarce on the wards and in clinics.

3.7.4.5 Output quality

The output quality is also a construct first introduced in the Venkatesh and Davis (2000) TAM2 study. The Output quality construct predicates the belief that people consider how well the system performs the relevant tasks. In scenarios where there is a choice of systems, end-users will choose the system that performs best. As such Output quality is expected to have a positive effect on Perceived ease of use, which has been tested in the work of Davis et al. (1992).

3.7.4.6 Training

Training is a construct not considered in the original Davis (1989) TAM study or the Venkatesh and Davis (1996) TAM 2 study. Interestingly, it was first pioneered by Venkatesh and Davis (1996) as part of their work in the area of Systems theory. Venkatesh and Davis (1996) through the use of empirical evidence assert that improving the self-efficacy of end-users will prove to be more effective in gaining end-user acceptance of the technology. The training construct has been used in subsequent TAM related studies, such as Amoako-Gyampah and Salam (2004) and more recently in Marshall et al. (2008). The findings are consistent and prove that training has a positive effect on perceived ease of use, which in turn has a positive effect on the intention to use the system. System training should also be combined with business process training, so that staff understand how to do the job rather than just how to use the IT system (Clegg et al. 1997).

3.7.4.7 Perceived interactivity

Perceived interactivity is a construct that has come from prior research using extended TAM models. This construct has been tested relatively recently by Yoon (2016), who asserts that Perceived interactivity comprises of responsiveness, personalisation, and connectedness and is known to drive positive cognitive responses. An essential characteristic of Perceived interactivity is that it accounts for system performance, the speed at which the system responds to requests and instructions from the end-user. Speed is of particular interest in healthcare, as there is a need to see many patients in a timely fashion. Delays in accessing patient information could lead to delays in care, which in turn could

lead to complications. Furthermore, this construct considers the accessibility and convenience of the system. The underlying theory behind Perceived interactivity comes from Ha and James (1989), who in their study of interactive systems determine that interactivity is the extent to which the system and the end-user respond to each other's communication needs, choices and information requirements.

3.7.4.8 Image

Image is also a construct first introduced in the Venkatesh and Davis (2000) TAM2 study. The Image construct demonstrates the belief that people like to maintain a positive image and that the use of innovations such as new systems elevates one's standing within the group, thus providing referent power (Venkatesh and Davis 2000). The theory behind this comes from the diffusion of innovations work pioneered by Moore and Benbasat (1991). In the case of the NHS hospitals, those that work directly with patients such as Doctors receive the most respect from their colleagues (Kmietovicz 2002) and thus portray a powerful image. Therefore those who use the system to further patient care should be seen to have a better image than those who do not, such as non-clinical administrative areas. As with the TAM2 model, Venkatesh and Davis (2000) assert that the Subjective norm construct has a positive effect on Image.

3.8 Chapter Conclusion

The literature has revealed factors why NHS projects fail, which includes a lack of stakeholder engagement (Juciute 2009), insufficient training (Alpay and Russell 2002; Devitt and Murphy 2004) and financial performance (Bacon 2013), which are uncontested. What has also come to light is that the SSC delivery model, with its centralised and one size fits all approach may be the root cause of technology acceptance issues within the NHS, which is my hunch but is an area of on-going discussion. The literature review also introduced the underlying theory for this research, which is the Davis (1989) TAM theory. TAM has been further developed by its creators as recently as 2008 (Venkatesh and Bala 2008). While the technology field is considered to be dynamic and ever-changing, as asserted by Fujita (2006), TAM was adopted for this research over all other theories as it still has the most credibility as a reliable predictor of technology

acceptance (Yarbrough and Smith 2007). There realisation is that TAM is the generally accepted model for understanding technology acceptance (Escobar-Rodriguez and Monge-Lozano 2012; Raunier et al. 2014) and TAM is the most prevalent theory used in healthcare technology-related studies, as asserted by Holden and Karsh (2010). TAM has been tested through decades of research and has demonstrated that it is reliable and adaptable, which has led to its adoption by many Information Systems researchers (Raunier et al. 2014). As the use of TAM is tailorable to different industry and technology settings, it is the most cited theory available to predict technology acceptance (Otieno et al. 2016). TAM through a significant number of studies has demonstrated that it can be used to predict and measure technology acceptance accurately (Turner et al. 2010) and does this through introducing two significant constructs, which are Perceived usefulness and Perceived ease of use (Davis 1989), which sit well with the beliefs of the RAG, which stem from experience. TAM has since been expanded to consider the influence that others have on behaviour and actual system use, measured through the Subjective norm construct (Venkatesh and Davis 2000). More recent developments with TAM allow for the delivery of improvements, providing IT managers with decision support (Venkatesh and Bala 2008), which is of significant interest in this research. The literature also revealed several additional factors to technology, including end-user training and speed of the system, which can be measured using a Perceived interactivity construct.

As with all TAM studies, a tangible outcome is the creation of a validated model. The conceptual model in this study leverages validated constructs from other TAM studies. Exhaustive attempts were made to find TAM studies that focus specifically on the NHS, with the conclusion being that the adoption of TAM in the NHS has been minimal. There was also limited literature found that demonstrates the use of TAM in the broader healthcare industry, which is a finding supported by Yarbrough and Smith (2007). Subsequently, this research study is ideally positioned to expand the existing body of knowledge, providing valuable insight into the technology acceptance in NHS hospitals and potentially the wider healthcare industry. Several other theories were also considered, such as Gamification theory, which was dismissed as its primary purpose is motivation and not measuring technology acceptance (Rigby 2015).

CHAPTER 4 USER SURVEY

4.1 Chapter Introduction

Participation is a fundamental aspect of this research. My belief, which is shared by the RAG is that the best way of understanding how systems are used and to expose issues is to simply ask the end-users. Such an approach is also integral to TAM related studies, all of which leverage a survey instrument to gain insight directly from end-users. In-line with other TAM studies, this research study is no different and a bespoke questionnaire used.

4.2 Planning

As discussed in Chapter 3, this research study leverages the theoretical components of TAM and also that of several other extended TAM studies. Using my research role and having undertaken the literature review, I had become accustom to the format of TAM related studies, core constructs and unique constructs. My research experience led to the gathering of TAM studies that identified the most appropriate constructs that determine the end-user's attitude towards using the system. The experience gained while working in the NHS hospitals provided ample opportunity to observe first-hand factors that influence the attitudes of staff when using computer applications. Observing in practice and leveraging the RAG has led to the creation of an extended TAM model that was introduced in Chapter 3. The conceptual model reflects the NHS hospital operating environment and the relationships that the RAG believes influence technology acceptance and system adoption. Validating the conceptual model involves testing the hypotheses, and a questionnaire was used as the primary research instrument for this. The questionnaire was specially engineered to confirm the suggested variables in the context of staff acceptance of the EDM system. The chosen sampling method was purposive sampling, which was focused and posed no limitations. In terms of the population, while the staff count at the two NHS hospitals participating in the survey is approximately 3000, not all of the staff are clinical staff or staff that use IT in their role. In hospitals, there are large numbers of staff that do not use of computer systems, include maintenance, driving, porters, cleaning and other ancillary roles. As such, the sample size was 1000.

4.2.1 Sampling Process

The sampling process involved selecting end-users of the EDM system.

The sampling frame consisted of staff that have access to the EDM system.

The sampling unit consisted of individual staff members that have access to the EDM system.

As the EDM system is typically used in close proximity with the patient, the vast majority of end-users are local hospital campus users. The end-users are easy to find as they work in designated clinical areas, such the inpatient wards.

4.2.2 Sources of Data and Communication Methods

The primary data source is the hospital end-users of the EDM system. Salkind (2010) refers to the primary data sources as being where data is collected first hand by the researcher for a project.

In terms of communication methods, participants received a printed pack which included the questionnaire, information about the study and consent. The questionnaire is included in Appendix B, and the information pack is included in Appendix C.

4.2.3 Questionnaire and Measurement Scales

A purpose-built questionnaire was used for data collection, which focused on gaining insight to the factors identified by the RAG, which represent constructs. The data collection preceded the quantitative analysis used to test the conceptual model. The primary use for the survey is to confirm the suggested variables for investigating the conceptual model. Using a questionnaire for this purpose is in keeping with other TAM related studies, such as Davis (1989).

4.2.4 Information Sought

A questionnaire was designed to test the conceptual model, with the questions being sourced from prior research and each response was measured. The information sought was a measure of agreement for each of the constructs in the conceptual model. Statistical analysis was then be conducted against the response data to test the relationships between the constructs in the proposed conceptual model. Overall, the responses to the questions provide insight in to the level of technology acceptance and suggested what the barriers might be.

4.2.5 Type of Questionnaire and Method of Administration

A paper-based questionnaire was issued to obtain the best possible response rate. The original intention was to use an electronic questionnaire product such as Survey Monkey, and then email out a link to it, which on the surface sounds like a quick and easy process. After further discussion with the RAG and thesis supervisor, a paper-based questionnaire was chosen as it provided the best fit. A paper-based instrument is more appropriate in hospitals, as most staff share computers, with very few having exclusive access to a computer. Such a concept may sound strange in a world full of computers, however, the function of NHS staff is to care of the patient, meaning more time is spent in front of the patient and less time at a computer. As such, computers are pooled and not all staff have access to a computer all of the time. Similar to this, not all hospital staff use email on a regular basis, such as nursing staff. The conclusion was that a paper-based survey would ensure the highest response rate, especially as a pivotal factor to test was if there were sufficient computers. Bowling (2005) describes the importance of choosing the right method of questionnaire delivery, as poor choices can lead to data quality issues and bias.

4.2.6 Individual Question Content

The ability to measure each construct was achieved by creating specific question content. For each construct, several questions were used to measure the construct, and the results aggregated. The question entries in table 4.2.10 demonstrate that several questions relate to each construct. Combining multiple questions for each construct is in keeping with the findings of Gleim and Gleim (2003), who strongly assert that single item questions relating to a construct are not reliable enough to make conclusions and so responses from multiple related questions for each construct should be aggregated instead. The use of aggregation is permissible with this questionnaire, as all questions use the same linear Likert-type scale. The convergent and discriminant validity of the responses provided a measure of how close the answers related to each other and as such, provided a measure of the integrity of the construct. The convergent and discriminant analysis is included later in this chapter.

4.2.7 Forms of Response

A 7-point Likert-type scale was used, which is a psychometric scale designed for use in questionnaires, as asserted by (Likert 1932). For each of the questions, respondents were instructed to respond with their degree of agreement on the 7-point Likert-type scale, whereby one indicates “strongly disagree”, and seven indicates “strongly agree”. The use of the Likert-type scale was in keeping with the Davis (1989) TAM study and other studies that measure attitudes (Göb 2007). The same scales are in everyday use with other TAM studies, including the ones cited in this research study. In terms of measurement scales, all theoretical constructs were operationalised using the validated items from prior research. Table 4.2.10 details the related questions and their sources.

4.2.8 Question-Wording

The question wording came from prior TAM research studies. Validated constructs were used along with their associated research questions, as described in Chapter 3. Such an approach is common amongst TAM studies, as the methodology was designed by the creators to be shared and extended by others (Venkatesh and Davis 2000). Using such an approach provides assurance for the data collection stage, as all questions have been tested through prior research studies.

4.2.9 Question Sequence

The question sequence follows the same flow as other TAM related studies. With this approach, all of the questions relating to each construct appear one after the other. The questionnaire then moves on to the next construct. Grouping the questions by construct makes the questionnaire more comfortable to complete for the respondent. The first set of questions directly align with the Davis (1989) original TAM survey question order. The constructs include Intention to use, followed by Perceived usefulness and Perceived ease of use.

4.2.10 Questionnaire Form Characteristics

The questionnaire was structured in two parts, demographic questions and construct related questions. The demographic questions were multiple-choice, allowing the respondent to pick the most appropriate answer. The demographic-based questions were used to gather the descriptive statistics, indicating the gender, role and experience of the respondent. The questionnaire can be found in Appendix B. For construct validation, the questionnaire comprised of blocks of questions, one block for each construct. Each construct question required the respondent to indicate their degree of agreement on a 7-point Likert-type scale, as introduced earlier in this chapter. On the scale used, a one is used to indicate strong disagreement and a 7 to indicate strong acceptance. The questions and their source are indicated in table 4.2.10.

	Statement	Source
	Intention to use	
ITU1	Assuming I have access to the system, I intend to use it.	Venkatesh & Davis (2000)
ITU2	Given that I have access to the system, I predict that I would use it.	Venkatesh & Davis (2000)
	Perceived usefulness	
PU1	Using the system improves my performance in my job.	Venkatesh & Davis (2000)
PU2	Using the system in my job increases my productivity.	Venkatesh & Davis (2000)
PU3	Using the system enhances my effectiveness in my job.	Venkatesh & Davis (2000)
PU4	I find the system to be useful in my job.	Venkatesh & Davis (2000)
	Perceived Ease of use	
PEU1	My interaction with the system is clear and understandable.	Venkatesh & Davis (2000)
PEU2	Interacting with the system does not require much mental effort.	Venkatesh & Davis (2000)
PEU3	I find the system to be easy to use.	Venkatesh & Davis (2000)
PEU4	I find it easy to get the system to do what I want it to do.	Venkatesh & Davis (2000)
	Subjective norm	
SN1	People who influence my behaviour think that I would use the system.	Venkatesh & Davis (2000)
SN2	People who are important to me think that I should use the system.	Venkatesh & Davis (2000)
	Image	
I1	People in the Trust who use the system have more prestige than those who do not.	Venkatesh & Davis (2000)
I2	People in my organisation who use the system have a high profile.	Venkatesh & Davis (2000)
I3	Having the system is a status symbol in my organisation.	Venkatesh & Davis (2000)
	Output quality	
OQ1	The quality of the output I get from the system is high.	Venkatesh & Davis (2000)
OQ2	I have no problem with the quality of the system output.	Venkatesh & Davis (2000)
	Perceived interactivity	
PI1	Access and response speed of the system is fast.	Yoon (2016), Wu (2000)
PI2	I think the system's content is useful to me.	Yoon (2016), Wu (2000), Ha & James (1989)
PI3	Using the system at any time is convenient.	Yoon (2016)
PI4	It is convenient to use the system everywhere.	Yoon (2016)
	Training	
T1	The kind of training provided to me was complete.	Amoako-Gyampah & Salam (2004), Venkatesh & Davis (1996)
T2	My level of understanding was substantially improved after going through the training program.	Amoako-Gyampah & Salam (2004), Venkatesh & Davis (1996)
T3	The training gave me confidence in the system.	Amoako-Gyampah & Salam (2004), Venkatesh & Davis (1996)
T4	The training was of adequate length and detail.	Amoako-Gyampah & Salam (2004), Venkatesh & Davis (1996)
T5	The trainers were knowledgeable and aided me in my understanding of the system.	Amoako-Gyampah & Salam (2004), Venkatesh & Davis (1996)
	Perceived Resources	
PR1	I have the resources I would need to use the system.	Mathieson et al. (2001), Ku (2009)
PR2	There are no barriers to me using the system.	Mathieson et al. (2001), Ku (2009)
PR3	I would be able to use the system if I wanted to.	Mathieson et al. (2001), Ku (2009)
PR4	I have access to the resources I would need to use the system.	Mathieson et al. (2001), Ku (2009)

Table 4.2.10 Survey questions with source

4.2.11 Relationship with the conceptual model

The relationship between the questionnaire and the conceptual model is demonstrated through the hypotheses in table 4.2.11 below.

	Hypotheses
H1	Perceived ease of use has a positive effect on the intention to use the system.
H2	Perceived ease of use has a positive effect on Perceived usefulness.
H3	Perceived usefulness has a positive effect on the intention to use the system.
H4	Subjective norm will have a positive direct effect on Intention to use.
H5	Subjective norm will have a positive effect on Image.
H6	Subjective norm will have a positive effect on Perceived usefulness.
H7	Perceived resources have a positive direct effect on the intention to use the system.
H8	Perceived resources have a positive effect on Perceived ease of use.
H9	Output quality has a positive effect on perceived usefulness.
H10	Training has a positive effect on Perceived ease of use.
H11	Perceived interactivity will have a positive effect on the intention to use the system.
H12	Image has a positive effect on Perceived usefulness.

Table 4.2.11 Hypotheses

4.2.12 Response Matters

A simple method of data coding was employed to record and analyse the responses, in line with the recommendation of Fink (2013). Coding is one of the most significant steps required to make sense of data and relies heavily on the expertise of the researcher (Basit 2003). The coding used is as follows: -

- To identify the question: -
  Each survey question reflected a variable and each variable was coded to reflect the related construct. E.g. PEU1 and PEU2 represented questions one and two belonging to the PEU construct.

- To indicate the response for a variable: -
  A 7-point Likert-type scale was used with an ordinal scale between 1 and 7. The coded value reflected the exact value made by the participant. E.g.

If the respondent chose 1 (Strongly disagree), then the coded value was 1.

- Several demographic questions were also asked and coded as follows: -

To indicate the response for job function, role mapping to ordinal values occurred as contained in table 4.2.12.1 below: -

Role response	Coded value
Admin	1
Nursing	2
Non-medical clinician	3
Medical clinician	4

Table 4.2.12.1 Role response coding

To indicate the response for experience, year mapping to ordinal values took place, as contained in Table 4.2.12.2 below: -

Experience response	Coded value
<1 year	1
<10 years	2
10 to 20 years	3
More than 20 years	4

Table 4.2.12.2 Experience response coding

To indicate the response for gender, gender mapping to ordinal values occurred, as contained in Table 4.2.12.3 below: -

Gender response	Coded value
Male	1
Female	2

Table 4.2.12.3 Gender response coding

4.2.13 Re-examination and Revision of the Questionnaire

The design of the survey instrument intentionally comprised of questions adopted from previously tested TAM studies. The inclusion of questions from other research studies ensured that the questions had been extensively tested, assuring the validity during subsequent use of the questions. During my research, if I found a more recent TAM study with the construct that matched the conceptual model, I would use the questions from that study, removing the older questions. With this approach the questions changed slightly to reflect the most recent TAM study.

The questionnaire was reviewed by the RAG to confirm validity, usefulness and ease of completion. The review also included checking that all required questions were present and that there was no overlap or ambiguity between questions for each construct. The review was a worthwhile exercise as it led to the questions being re-ordered, which made more sense for the respondents.

4.2.14 Questionnaire Pretesting

The questionnaire underwent extensive pretesting by five of the key informants. Pretesting involves releasing the questionnaire to a pilot group of participants, to reveal defects, garner feedback and allow for questionnaire improvement before a full release (Bolton 1993). Pretesting provides an exclusive focus on fixing obvious problems, as asserted by Presser et al. (2004). From reviewing the results and listening to the feedback, the pretesting revealed that the questionnaire wording proved to be ambiguous. By way of example, when the questionnaire spoke of resources, it was not clear that this meant computers and IT equipment. The questionnaire was then further refined to include minor word amendments, checked over and prepared for distribution to the research population. What also came to light was that specific questions relating to constructs such as Perceived resources and Training had the potential to reveal answers that could lead to areas of immediate improvements. For example, perceived resources would reveal if the number of existing computers appeared to be sufficient. Having adequate technology resources was an area of specific interest for the RAG members, as there was a belief that limited resources, such as a lack of computers, had an adverse knock-on effect to Perceived usefulness.

The hunch of the RAG was that the system is only useful if it can be accessed nearby.

4.3 Action

The method of research administration is described in this section. As part of conducting this research ethically, all responses were anonymous, and consent provided, this was by design, to encourage staff to be open and honest about their experiences. Appendix C contains the information and consent pack. The storage of the anonymous data was on a laptop computer encrypted hard-drive, where the analysis later took place, and the paper copies destroyed. Regular backups of the data took place. No transmission of the data to third parties took place.

Using my project management experience, I am aware that poorly planned activities lead to poor execution and uncertain outcomes, which is the opposite of project success (Munns and Bjeirmi 1996). To avoid this, I planned the administration activities as a carefully sequenced set of activities as below: -

i) A paper-based questionnaire approach was adopted and 1000 packs were printed, so that the entire sample could participate. On reflection, I was naive to expect so many questionnaires to be completed and so should have printed less.

ii) Questionnaires were delivered by me to central areas at both hospitals covering the inpatient wards, outpatient clinics and the main administration areas for the clinical staff. Each central area is controlled by a Sister or Charge nurse (male equivalent) and so I asked them if they could encourage staff to complete the self-administered questionnaires. My observation, which is shared by the RAG is that nursing is very structured, just like the army, and as such the Sister, like a platoon sergeant has great powers of persuasion within their domain. In hind sight, rather than just delivering the questionnaires to areas like wards and clinics, I should have also placed questionnaires in the ward and clinic break rooms, a place where staff go to have a break. Such a realisation only came to light when I was delivering

another project which built new areas, where I came to better understand how such spaces were used.

iii) Questionnaires were collected every second day for processing, as I would typically visit just one hospital on a given day. On some days there were no completed questionnaires to collect, which was disappointing, but made the task of visiting each area quicker! I was mindful of my dual role and did not want to use my professional position to coerce staff into completing the questionnaires. Such an approach may negatively or positively bias the responses. As all responses were anonymous, I did not know who had or had not completed the questionnaire and so I did not know who to target. I believe I took the right approach with this.

4.4 Observation

From a sample of 1000 questionnaires, the yield was 261 valid completed questionnaires, a response rate of 26% which exceeded the recommended minimum of 200 questionnaires made by the Thesis Supervisor. Statistical analysis and structural equation modelling (SEM) were conducted on the questionnaire responses. In terms of analysis tools, all statistical analysis was conducted using SPSS version 25. SPSS was specially selected over other tools such SAS as it provided the vast majority of functions required to analyse Likert-type scale based surveys (Gadermann et al. 2014). For SEM, the purpose-built SPSS Amos version 24 product was used. SEM tools are highly complicated tools that must be used precisely to conduct an accurate and meaningful analysis (Blunch 2008). A total of 261 completed surveys was used for quantitative analysis and modelling.

4.4.1 Quantitative Action Research

Quantitative research is a scientific approach typically associated with the positivist paradigm, as asserted by Lin (1998). While this research method aligns perfectly with my historic personal epistemology, it was chosen because the prior research that this research leverages has used this method to test and validate their conceptual models. The data collected using quantitative research methods represent the hard facts, an actual point in time representation of technology acceptance within the NHS hospitals. As part of the quantitative analysis, statistical analysis techniques were used to validate the data Such techniques were also used to test the reliability of the survey data and to determine the causal relationships between the various constructs in the conceptual model. The estimated path coefficient indicates the effects of the relationships between the constructs and the conceptual model was updated to reflect them. Much of the research revolved around leveraging the basic constructs of TAM, such as Perceived usefulness, Perceived Ease of Use and the resulting Intention to use construct Davis (1989). Newer relevant constructs tested through prior research that stemmed from the experience of the RAG were also included in the model. The resulting conceptual model is a hybrid model that has been purpose-built to define the factors that were believed to affect technology acceptance within the NHS hospitals.

4.4.2 Common method variance (CMV)

Method variances in behavioural research such as CMV are one of the main sources of measurement error, which threaten the validity of conclusions drawn on the relationships between measures, as asserted by Podsakoff et al. (2003). CMV is a variance that is attributed directly to the measurement method and not the construct that the measurement represents, potentially inflating or deflating observed correlation. One such attributer is respondents that seek to be consistent in their responses, searching for similarities in questions, producing relationships that would not ordinarily exist.

There are ways of preventing the effects of CMV, whereby Lindell and Whitney (2001) promote the designing questionnaires to support a test of discriminant validity and Podsakoff et al. (2003) recommend obtaining measures of both

predictor and criterion variables from multiple sources. The approach taken with this research seeks to implement both recommendations. Outside of preventative methods, there are also ways of detecting CMV, which include Harmans Single Factor Test and the Correlation Matrix Procedure, as asserted by Rodrigues-Ardura and Meseguer-Artola (2020).

4.4.3 Respondent demographic profiles

To ensure that the survey instrument would return appropriate, meaningful and consistent data, much time was spent planning. Several sampling methods were reviewed, including random sampling, stratified sampling and systematic sampling, as introduced by Ardilly and Tillé (2006). After reviewing the application of the various sampling methods, the purposeful sampling method was selected, as it demonstrated the best fit to achieve the goals of this research study. The purposeful sampling method is known for the identification and selection of information-rich cases relevant to studying the phenomena (Palinkas 2015). Within purposeful sampling, several strategies exist, ranging from Snowball, asking people to recommend others, to the targeted “Criterial-I” strategy. After further consideration, “Criteria-I” would be best suited for standardised questionnaires, as asserted by Patton (2002).

The demographic split of respondents was also proportionate and representative, with all staff groups responding, including nurses and doctors, with the typical 5:1 ratio reflecting that there are far more nurses than doctors. There was also a good spread of experience across the entire experience spectrum, ranging from 0 years to beyond 20 years. In terms of gender split amongst the respondents, 83% were female respondents, and 17% male respondents. While this appears to be unbalanced, it is worth considering that 80% of the NHS front line agenda for change staff are female, as asserted by NHS Employers (2017). Roles in nursing, physiotherapy and other non-medical healthcare professions are predominantly staffed by females. Table 4.4.3 includes frequency tables, providing a complete demographic profile breakdown for the respondents.

Gender

	Frequency	Percent
Male	44	16.9
Female	217	83.1
Total	261	100.0

Role

	Frequency	Percent
Administrative	65	24.9
Nurse	143	54.8
Care professional (non medical)	23	8.8
Doctor/Consultant	30	11.5
Total	261	100.0

Experience

	Frequency	Percent
<1 year	28	10.7
<10 years	60	23.0
10 to 20 years	94	36.0
>20 years	79	30.3
Total	261	100.0

Table 4.4.3 Respondent demographic profiles

4.4.4 Descriptives

In this section, I use descriptive analysis to briefly summarise the data set, as recommended by Mann (1995), providing a summary of the sample and measures (Conway 1963). The use of descriptive analysis is the standard practice for introducing data sets (Mann 1995). Extensive testing and analysis of the variables took place using the survey data. The descriptive statistics, such as the mean and standard deviation are included in table 4.4.4. For the questionnaire responses, a 7-point Likert-type scale was used, with 1 representing a strong disagreement and 7 representing a strong agreement. There were no missing values identified.

From an initial analysis perspective, what was evident was that the mean response for each of the constructs was less than 4. On the seven-point Likert-type scale, 4 is the midpoint and is used to signify neither agree or disagree. The interpretation for this is that a low mean score relates to the vast majority of respondents having a lower than the expected attitude towards using the system. There can be many reasons for this outcome, and it accepted that the overall end-user experience of the system is negative. Thus, a low score signifies an issue with technology acceptance.

As reviewing the patient medical record is vital to the delivery of patient care, as asserted by Black et al. (2011), the low scores confirm that there is a significant business problem, which has the potential to impact patient care. The possible causes for this are discussed in Chapter 5. It is also worth noting from the descriptive analysis that the Image variable has a low mean and standard deviation. Having such low values can be interpreted as the majority of the respondents not feeling that having access to the system is prestigious or privileged.

Construct	Mean	Standard Deviation (SD)
Perceived ease of use	3.62	1.63
Perceived usefulness	3.73	1.57
Subjective norm	3.46	1.68
Output quality	3.16	1.55
Perceived resources	3.69	1.71
Image	2.90	1.53
Training	3.27	1.77
Perceived interactivity	3.32	1.63
Intention to use	3.84	1.60

Table 4.4.4 Descriptive analysis

4.4.5 Analysis of convergent validity

The questionnaire was specifically designed to adequately test the operationalisation of each construct and to ensure a high level of integrity, and so multiple questions were used for each construct. As such, each construct has a "1 to many" relationship with the survey questions, which is a technique used to increase the overall accuracy and reliability of respondent selections. As multiple responses are being aggregated to form the construct, additional ways of measuring the construct validity are now possible. Two tests are required to establish the validity of the constructs. The first test is a consistency test of the responses making up the construct, which needs to observe as being related (Loevinger 1957). The second test is used to ensure that constructs that should not be related are observable as not being related (Cronbach and Meehl 1955). The core principles of construct validity testing originated in the 1950s, pioneered by Loevinger (1957) and Cronbach and Meehl (1955), amongst others. While construct validity tests continue to evolve, you can find the same principles in use today, as asserted by Straus (2009). A commonly used method of validity testing is the statistical technique of convergent validity, which has been specially created to achieve this goal. Convergent validity is used to measure the agreement between multiple items that measure the same phenomena (Hair et al. 2010). In simple terms, this method tests the level of agreement amongst variables that measure a single observation, which are the multiple questions that make up the construct. Convergent analysis now forms the standard approach for testing constructs arising from survey responses, and it aligns well with datasets that use Likert-type scales. Like all statistics, there is a heavy reliance on mathematical algorithms. The convergent analysis is based on using factor loadings to calculate the composite reliability and average variance extracted, as asserted by Hair et al. (2010). The closer the resultant value is to 1, the higher the correlation. For validity purposes, factor loadings should always exceed 0.5, as asserted by Jolliffe (1986). Likewise, the composite reliability must exceed 0.7, and the average variance extracted should exceed 0.5. Constructs that lead to values outside of these ranges are candidates for removal, as they will most likely not relate to the tested phenomenon, as asserted by Hair et al. (2010).

A significant outcome in this research was the achievement of a high level of convergent validity for all constructs. Factor loadings were between 0.81 and 0.98 (exceeding 0.5), composite reliability ranged between 0.92 and 0.97 (exceeding 0.7), with an Average Variance Extracted between 0.7 and 0.91 (exceeding 0.5). Table 4.4.5 contains the convergent analysis.

Construct	Item	Loading λ	Composite Reliability (CR)	Average Variance Extracted (AVE)
Perceived ease of use	PEU1	0.921	0.969	0.885
	PEU2	0.951		
	PEU3	0.952		
	PEU4	0.939		
Perceived usefulness	PU1	0.955	0.970	0.888
	PU2	0.947		
	PU3	0.934		
	PU4	0.934		
Subjective norm	SN1	0.958	0.953	0.911
	SN2	0.951		
Output quality	OQ1	0.918	0.928	0.865
	OQ2	0.942		
Perceived resources	PR1	0.908	0.974	0.902
	PR2	0.932		
	PR3	0.979		
	PR4	0.978		
Image	I1	0.925	0.969	0.912
	I2	0.972		
	I3	0.968		
Training	T1	0.965	0.990	0.951
	T2	0.976		
	T3	0.98		
	T4	0.981		
	T5	0.975		
Perceived interactivity	PI1	0.798	0.931	0.773
	PI2	0.817		
	PI3	0.952		
	PI4	0.938		
Intention to use	ITU1	0.96	0.952	0.909
	ITU2	0.947		

Table 4.4.5 Convergent validity

4.4.6 Discriminant validity

Discriminant validity tests the degree to which the operationalisation of the construct does not correlate with other operationalisations that the construct theoretically should not correlate with. In simple terms, this method is used to test that unrelated constructs do not relate to other constructs. As such, it is a test of distinctness and offers further validation of the survey data. Two main methods are commonly used to test discriminant validity, as asserted by John and Benet-Martinez (2000). The method applied in this research is the Fornell and Larcker (1981) criterion method, as indicated in table 4.4.6 below. Such a method is the most commonly used method and typically the method applied by extended TAM studies. Using this method, each construct's Average Variance Extracted (AVE) is compared with the squared correlations of other constructs in the model and this value must be higher. An alternative method is the "heterotrait-monotrait" (HTMT) method, as asserted by Henesler et al. (2015).

	The square root of Average Variance Extracted (AVE) on the diagonals								
	OQ	**PEU**	**PU**	**ITU**	**PI**	**T**	**SN**	**I**	**PR**
OQ (Output Quality)	0.93								
PEU (Perceived Ease of Use)	0.926	0.941							
PU (Perceived usefulness)	0.899	0.928	0.943						
ITU (Intention to Use)	0.848	0.875	0.927	0.954					
PI (Perceived Interactivity)	0.867	0.863	0.877	0.851	0.879				
T (Training)	0.848	0.906	0.827	0.814	0.846	0.975			
SN (Subjective Norm)	0.845	0.861	0.926	0.952	0.839	0.811	0.955		
I (Image)	0.844	0.797	0.839	0.735	0.792	0.805	0.821	0.955	
PR (Perceived Resources)	0.843	0.844	0.822	0.888	0.858	0.83	0.837	0.744	0.95

Table 4.4.6 Discriminant validity

4.4.7 Reliability

In addition to the construct validation tests described in earlier sections, the reliability of the constructs undergoes testing before use. Measuring the internal consistency of the measurements is the preferred way of achieving this. In simple terms, the internal consistency is a measure of how closely related a set of items are with each other (Streiner 2003). The accepted statistical test for internal consistency (reliability) testing is Cronbach's alpha, as asserted by Cortina (1993) and Streiner (2003). Pioneered over fifty years ago, the Cronbach alpha test (Cronbach 1951) still exists in the same form today. There is an assertion by Cortina (1993) that Cronbach's alpha is one of the most potent statistics used in the construction and use of surveys. To be deemed reliable, constructs must yield an alpha value of 0.7 or above, as asserted by Cortina (1993). The alpha test is also the most common reliability test for surveys that use a Likert-type scale. The alpha test was also used to test the reliability of the constructs in the original TAM (Davis 1989) study. In terms of this research study, the reliability of each construct was tested using SPSS v25 and found to have high reliability, ranging between 0.974 to 0.977. As such, there was no need to remove any constructs from the model at this stage to improve the model. Table 4.4.7 depicts the reliability of each construct.

Construct		Cronbach's Alpha α
Perceived ease of use	PEU1	0.974
	PEU2	
	PEU3	
	PEU4	
Perceived usefulness	PU1	0.974
	PU2	
	PU3	
	PU4	
Subjective norm	SN1	0.975
	SN2	
Output quality	OQ1	0.975
	OQ2	
Perceived resources	PR1	0.975
	PR2	
	PR3	
	PR4	
Image	I1	0.977
	I2	
	I3	
Training	T1	0.975
	T2	
	T3	
	T4	
	T5	
Perceived interactivity	PI1	0.974
	PI2	
	PI3	
	PI4	
Intention to use	ITU1	0.975
	ITU2	

Table 4.4.7 Construct reliability test

4.4.8 Hypotheses testing

As part of the research design, Chapter 3 introduced a proposed conceptual model. After creating the model, no less than 12 hypotheses were explicitly identified to test the model. Before hypothesis testing, the validity, integrity and reliability of the constructs were tested using commonly accepted statistical techniques. The techniques employed are used explicitly in TAM studies and rigorously tested through prior research. The statistical techniques include divergent and convergent validity tests and Cronbach's Alpha for reliability (Steiner 2003). The estimated path coefficient was used to test each hypothesis in turn and determine if the effect of the construct is positive (Chatterjee et al. 2000). Figure 4.4.8 below provides a graphical representation of the research hypothesis.

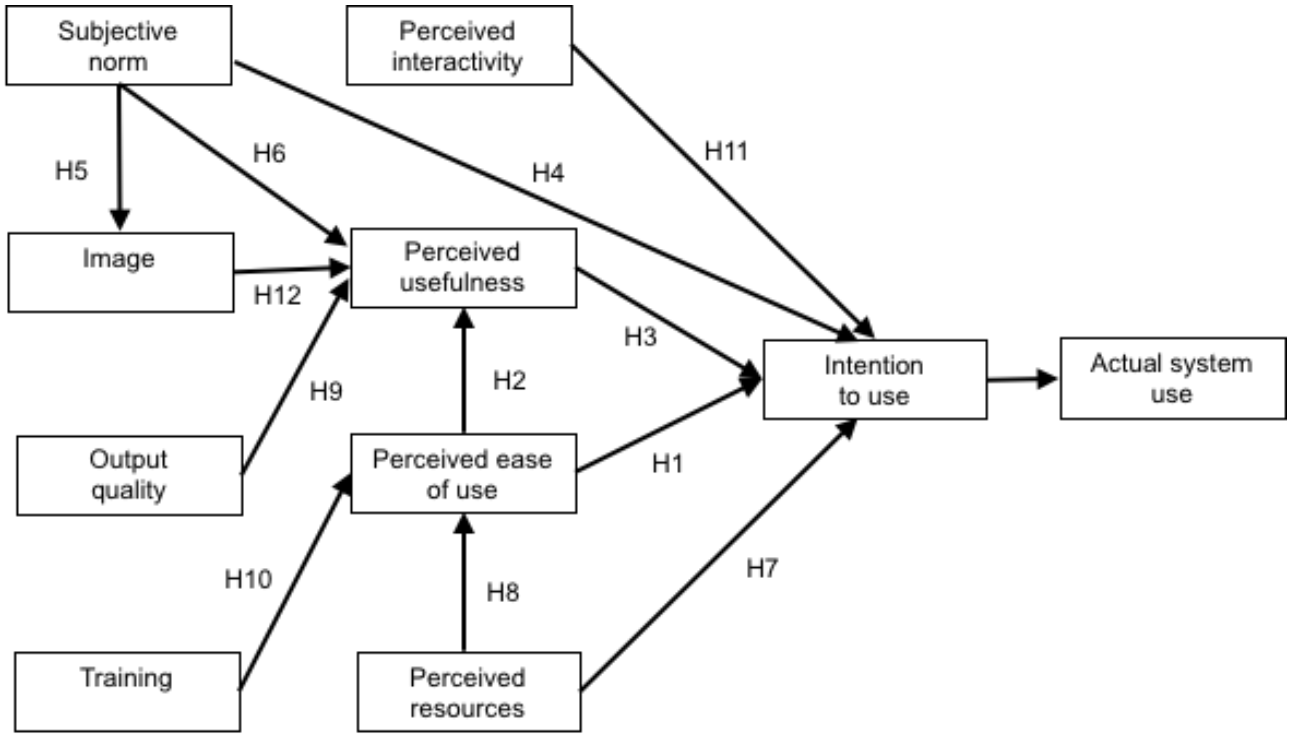

Figure 4.4.8 Research hypothesis

The proposed conceptual model, as illustrated in Figure 4.4.9, indicates the causal relationships amongst the various constructs. Estimates of the path coefficient are used to determine the overall predicting power of the conceptual model (Land 1969). The method employed determined the level that constructs depend on each other and their influence on the intention to use the system.

As standard practice, statistical techniques were used to perform the path analysis by estimating the standardised path coefficient. Techniques were employed to determine how well the data collected from the survey instrument fitted the conceptual model and the hypothesis used to test it, as recommended by D'Agostino and Stephens (1986). The tests and analysis revealed that Subjective norm (SN), Perceived resources (PR) and Perceived usefulness (PU) had a significant positive effect on Intention to Use (ITU) (H4: $\beta = 0.405$, $p < 0.05$; H7: $\beta = 0.318$, $p < 0.05$; H3: $\beta = 0.280$, $p<0.05$). Perceived ease of Use (PEU) was found not to have positive effect on Intention to use (ITU) (H1: $\beta = 0.010$, $p < 0.05$). Perceived interactivity (PI) was found not have a positive effect on ITU (H11 $\beta = -0.200$, $p < 0.05$). Perceived ease of use (PEU) and Subjective norm (SN) both had a powerful significant effect on Perceived usefulness (PU) and with Image (I) also having positive impacts (H2: $\beta = 0.421$, $p < 0.05$; H6: $\beta = 0.381$, $p < 0.05$; H12: $\beta = 0.250$, $p < 0.05$). Subjective norm had a significant positive effect on Image (H5: $\beta = 0.795$, $p < 0.05$). Finally, Training (T) had the most significant effect, with a powerful positive effect on Perceived ease of use (PEU), with Perceived resources (PR) also having a positive effect (H10: $\beta = 0.599$, $p < 0.05$; H8: $\beta = 0.319$, $p < 0.05$). Output quality (OQ) was found not to have a positive effect on Perceived usefulness (PU) (H9: $\beta = 0.084$, $p<0.05$). Overall, the analysis and results support H2, H3, H4, H5, H6, H7, H8, H10, H12 however do not support H1, H9 and H11. Table 4.4.9 provides a summary of the hypothesis tests.

4.4.9 Hypotheses Validation

The analysis tested each of the relationships in the conceptual model. Table 4.4.9 below presents a summary of the tests.

Hypotheses		Standardised path coefficient	t-Value	Result
H1	PEU→ITU	0.010	0.188	Not supported
H2	PEU→PU	0.421	8.581	Supported
H3	PU→ITU	0.280	4.450	Supported
H4	SN→ITU	0.405	8.097	Supported
H5	SN→I	0.795	21.059	Supported
H6	SN→PU	0.381	9.106	Supported
H7	PR→ITU	0.318	6.557	Supported
H8	PR→PEU	0.319	6.792	Supported
H9	OQ→PU	0.084	1.706	Not supported
H10	T→PEU	0.624	13.286	Supported
H11	PI→ITU	-0.200	-0.365	Not supported
H12	I→PU	0.118	2.953	Supported

Table 4.4.9 Summary of hypotheses tests

With the path analysis complete, the conceptual model was revised to reflect the results of the hypothesis tests along with the estimated coefficient path, which is illustrated in Figure 4.4.9.

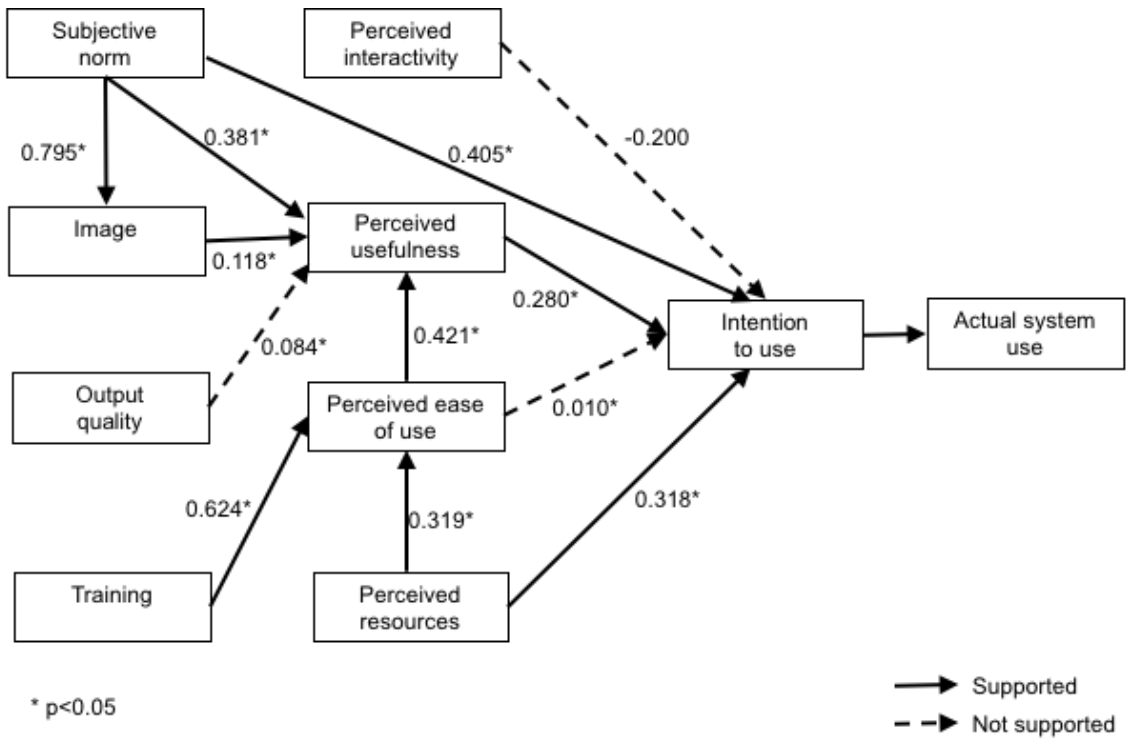

Figure 4.4.9 Revised conceptual model with co-efficient paths

4.5 Reflection

Much was learned from the user survey, including the relationships between the constructs and which constructs were most dominant. The RAG interpreted the quantitative analysis as the perceived usefulness of EDM driving the system usage, despite the system not being easy to use and output quality having no bearing. It is not uncommon to find that Perceived ease of use is not supported in TAM research, such as with Lee and Lee (2019). Perceived interactivity, which reflects system performance and speed had limited bearing on the intention to use the system. This most likely stems from the fact that Perceived interactivity in the original Yoon (2016) model was expected to have a direct relationship with end-user attitude and only an indirect relationship with Intention to use. Such relationships are not present in the conceptual model. Pressure from colleagues and indirectly system training appears to be driving the intention to use the system. Such an interpretation was based purely on the analysis of numeric responses and so the RAG was keen to understand why this was the case and the underlying issues. The RAG determined that the only way to gain such insight would be for further participation and to introduce additional sources, such as key stakeholders through interviews. Such an approach allows for explanations and problems to be presented, which is discussed in the next chapter.

On reflection, this study was designed to follow the core principles of TAM methodology, and all additional constructs had previously been validated. Therefore, the outcome of a robust and comprehensive extended TAM model that can be adopted by the NHS hospitals is not a surprise. It is worth noting that in the two hundred or so TAM studies that I reviewed, all delivered working conceptual models. I, therefore, conclude that the TAM methodology is robust and continues to provide researchers with tangible outcomes.

4.6 Chapter conclusion

In summary, the quantitative analysis component of this research study has concluded. A tangible outcome is a validated conceptual model that can be adopted by the NHS hospitals, which is constructed in the same fashion as all other extended TAM studies. The conceptual model proposed several constructs as being the determinant factors for technology acceptance in the NHS hospitals, which was validated against the business problem. The proposed constructs were tested using an accompanying survey instrument, which is included in Appendix B. The survey instrument consisted of questions used in other TAM related studies. The data gathered from the survey instrument underwent tested using accepted statistical techniques. The statistical analysis revealed a high degree of convergent and discriminate validity. Testing reliability also revealed a high degree of reliability. Robust analysis took place, and each hypothesis tested in turn. The causal relationships in the proposed conceptual model were tested and found to hold in the majority of cases. While Perceived ease of use did not have a positive effect on the intention to the use the system, it has been kept in the model as it is integral to TAM. Output Quality was also found not to have a positive impact but has been kept in the model in accordance with extended TAM (TAM 2) models. The Perceived interactivity construct, did not have a positive effect on Intention to use and is not integral to TAM, or TAM 2 and so has been eliminated from the conceptual model. The resulting model has been accepted as an accurate model reflecting the NHS hospitals and the experience of the RAG.

CHAPTER 5 STAKEHOLDER INTERVIEWS

5.1 Chapter Introduction

To gain further insight into the business problem and technology acceptance in the NHS hospitals, a qualitative analysis was also undertaken. As with other complex research studies, combining multiple research methods was recommended, with the quantitative analysis demonstrating the current position and the qualitative research offering up plausible explanations (Patton 1990; Ostlund et al. 2011). Such a hybrid approach is recommended by Ragin et al. (2003) who provide a compelling need to use multiple methods to bridge the gap between prediction and understanding.

5.2 Qualitative Analysis Rationale

The reason for adding a qualitative aspect to this research study was to venture beyond measuring the level of the technology acceptance of the EDM system and to be able to propose improvements, a benefit from my dual role. In chapter 4, aggregations of Likert-type scale data were used in isolation, providing a result with no explanation from system users. The RAG interpreted the analysis using its lens, but sought clarification. To be sure, a clearer picture is required and obtainable by associating explanations gained through additional cycles of participation, observation and analysis. In this case, interviewing key stakeholders and aligning the explanations with the Likert-type scale responses provides greater insight. The inclusion of this research approach provides an opportunity to compare and contrast the findings, providing far more depth, targeting improvements and providing a baseline for comparing future AR cycles.

My experience has led me to believe that quantitative analysis alone would not be able to provide much insight, as its objective and qualitative analysis is subjective (Komorowska 1993), so combining the two methods provides a holistic picture for this research.

5.3 Planning

The RAG was instrumental in planning this stage of the research, helping to determine the roles that should participate and the questions that should be asked. The approach taken was to obtain direct feedback by interviewing key informants.

5.3.1 Participants

The purposive sampling method was used to ensure those with relevant experience contributed, as recommended by Teddie and Yu (2007). Several key informants from each hospital were asked to represent a specific hospital user group that is required to adopt and accept the electronic system in favour of paper-based patient records. The inclusion criteria were job functions that were invited to the system implementation workshops, that would use the EDM system in practice, being senior staff with a minimum of five years' experience. Five key informants were interviewed, one per significant job function. Three informants were sourced from one hospital and two from the other. On reflection, it would have been nice to have included three informants from each hospital, however no further roles were deemed as necessary and balancing the number would not have added any further insight, as the job roles, job plans and system are the same irrespective of hospital site.

The roles are described as follows: -

5.3.1.1 Clinical Nurse Specialist

Clinical Nurse Specialists (CNS) are registered nurses with the Royal College of Nursing. A CNS will focus on a specific health condition or health discipline, such as cardiology. Nurses who become a CNS are senior and experienced. Such nurses through their advanced degrees and a minimum of five years of practice acquire expert level in diagnosing, treating and advising patients, as asserted by RCN (2010). The CNS will be introduced to the patient before their procedure and will be available throughout the patient's journey. Depending on the patient's condition, the patient may maintain regular contact with the CNS

long after any surgical procedure. As such, a CNS will build up an intimate knowledge of the patient through studying the available medical history, meeting with the patient and updating the patient's medical record. The CNS role is a large contributor to the medical record. A CNS may assist ward nurses by performing interventions for the patient. To ensure continuity of care, the CNS is expected to liaise with other health professionals in the community.

5.3.1.2 Ward Sister

The ward sister is also registered nurse with the Royal College of Nursing. The Ward Sister or charge nurse (male equivalent) are experienced senior nursing staff who are responsible for an entire ward of patients, the ward staff and the patient's care. As such, Sisters possess significant education and experience over regular nurses and are role models, having attained ten or more years' experience in practice. The RCN (2011) makes a case for further supervisory and managerial opportunities for Sisters. The Ward Sisters role is junior to that of Matron. The Matron role now oversees several wards, and so involves more administrative activities. The Ward Sister role is now quite varied, with a mix of caring and administrative duties. Modern inpatient ward Sisters now spend a considerable amount of time using computer systems to review patient records, document handovers, request diagnostic tests and transfers.

5.3.1.3 Consultant physician

A Consultant is the most senior hospital doctor and is responsible for delivering the patients care BMA (2017). The Consultant physician is typically a specialist in an area of medicine and will have eight years or more specialist training. All Consultants are required to hold current registration with the British Medical Association. The Consultant is responsible for a team that will help diagnose the patient's condition. Ultimately, this typically leads to the team performing a surgical intervention or other treatment. Such teams include junior doctors, surgeons and Clinical Nurse Specialists. The initial patient engagement with a Consultant is through a consultation meeting, typically in an outpatient setting. Some follow-up consultation meetings will take place until the final discharge of the patient.

5.3.1.4 Surgeon

A Surgeon is a role similar to that of a consultant physician. The main difference is that the surgeon will be responsible for undertaking surgical procedures. Such expertise is learned through many years of experience, often making critical decisions, having full accountability for a patient's life. As such, the surgeon leads the theatre team and will be responsible for liaising with Consultant physicians and patients.

5.3.1.5 Medical secretary supervisor

The medical secretary is a vital administrative role as it provides the linkage between the Consultant and the patient, as asserted by Alis and Blair (2003). Administrative support includes processing patient referrals, booking appointments, transcribing clinic outcome letters, booking diagnostic tests and fielding enquiries. The role ensures that the Consultant does not get bogged down in admin and remains focussed on patient care. As such, medical secretaries get to know the patients and their clinical history. As medical secretaries are often responsible for booking appointments, they have a good understanding of where the patient is on their care pathway and what the next step is in the process. The Medical secretary supervisor has five or more years senior practitioner experience, responsible for supervising several medical secretaries, ensuring a consistent level of service to patients and Consultants.

5.4 Action

The main action in this AR cycle involves conducting interviews with the key informants.

5.4.1 Interview Protocol

The opening question was: -

Please tell me about your experience with the EDM system, what you think about it, like about it and hate about it? For maximum insight, the advice to informants was to speak freely and on behalf of their job function. All responses were anonymous, and each informant provided consent. The anonymous statements were initially handwritten, then typed up, whereby the anonymous data was then stored on a laptop computer encrypted the hard drive. The data analysis took place on the laptop computer, and routine backups of the data took place and paper copies destroyed. There was no data transmission to third parties. Handwritten notes were made as opposed to recording the interviews. The main reason for written notes was that it was my belief that recording the interviews may bias the responses, discouraging the informant from speaking freely. In addition, a suitable recording device was not readily accessible and I would be concerned during the interview if it was not working properly, having to start over again.

On reflection, these interactions were challenging, as there was a need to be aware of personal biases (Reason and Bradbury 2001) and the dual role that I hold. The approach was to listen to the informant and to avoid leading the conversation or putting words in their mouth. Writing and listening at the same time was also a challenge for me, so in hindsight, perhaps recording the interviews would have been better. The notes were made in chronological fashion, noting key statements one by one for later analysis. When typing up the notes, statements were organised by themes, which were directly associated with the constructs in the conceptual model.

5.4.2 Backup questions

As it was crucial to gain specific insight relating to the constructs of the conceptual model, there was a need for backup questions. These questions were made available in situations where the free-flowing information was incomplete for the study purpose. The backup questions included: -

- What works well? (Perceived usefulness)
- What are you unable to do? (Output quality)
- Do you feel that you use the system well? (Perceived ease of use)
- What aspects could be improved?
- Would you recommend using the system to others (Subjective norm)?
- Did you receive any training (Training)?
- Do you feel that it is prestigious to use the system (Image)?
- Are there enough computers (Perceived resources)?

5.5 Observation & Analysis of Content

A total of five statements were analysed.

Responses from the five statements were aggregated by theme, with each theme representing a construct. Organising the responses by construct provided a simple way to link the qualitative responses back to the quantitative data. What I was looking for was commonality of responses amongst the informants to understand the significance of an issue, e.g. If many of the informants reported that the system was slow. The sharing and analysis of the themes, especially relating to what worked well and what can be improved took place with the RAG for discussion and to plan improvements. The approach formed an essential part of the learning process and AR cycle (McGill and Beaty 1995). Much insight came from the key informants and problems and explanations were provided. Several common themes were identified by the key informants. The themes are explored through the conceptual model constructs as follows: -

5.5.1 Perceived ease of use

The system is challenging to use as staff are unable to use the search feature on “legacy” documents, just on “day forwards” documents. For legacy scanned documents, searching across a patient’s record and searching in a document to find a phrase is not possible. Instead, users must scan read documents to see if there is anything that is relevant. The implication of this issue is that a patient consultation only lasts for fifteen minutes, and this slows them down considerably, such that searching through the paper medical record was much quicker. It was also noted that medical history is used extensively to check for adverse reactions to drugs and complications. A significant assertion by one of the informants was that risks during surgery could be significantly reduced by understanding the patient’s medical history. Recommendations provided by the informants included fixing the search facility so that any document can easily be searched.

5.5.2 Perceived usefulness

The system is an improvement over the paper record, as the paper record sometimes goes missing. There is also no longer a need to wait for paper notes to be delivered by the records team. One significant issue that came to light is that it can take up to two weeks for some patient documents to appear in EDM, which is a problem if the patient needs to be seen sooner. It was also raised that there is still a need to look at the patient’s purple folder as well as EDM, as inpatient records are not scanned until after discharge. The informants recommended scanning all documents into the system quicker.

5.5.3 Subjective norm

The majority of informants did not allude to any pressure placed on them to use the system or them placing pressure on others to use the system. There was one exception, who stated that managers require medical secretaries to use EDM. Such a finding was quite a surprise, as it was assumed that during the implementation of the system that managers would ensure that the system be used extensively across their teams.

5.5.4 Perceived Resources

The majority of informants reinforced the fact that there are not enough computers on the wards. The implications are that end-users are simply unable to use the system when required, as no computer is available. In the case of doctors, there are typically offices available for them in different locations, which is not ideal and nurses have no choice but to wait for a computer to become available. Such a finding is significant as this could be the root cause of the low acceptance levels. The informants made recommendations including adding more computers and enabling the printing of patient records.

5.5.5 Output Quality

None of the key informants thought that the system was not capable of performing its intended function; however, it was acknowledged that issues such as searching would need to be fixed for the system to perform well. Other issues raised included the inclusion of blank pages, which wastes time as you have to scroll past them. There was also an issue identified around printing, in that the system does not allow documents to be printed, so some staff make notes on paper as no computer is available when they need it. An unexpected insight was that some of the informants mentioned that not being able to print the patient record has a positive benefit on the environment, leading to less waste. Recommendations were made to fix the search facility for legacy documents, to remove blank pages and to enable printing. Such a finding is a surprise as this means that once the issues are fixed, comprehensive and sustainable technical acceptance of the system could be achieved.

5.5.6 Training

The majority of informants stated that no system training was provided and that using the system was self-learned. In one case, it was determined that training should not be necessary as modern systems must be intuitive. Such a finding was alarming as training should have been provided during the project deployment phase to ensure that the system is used appropriately.

5.5.7 Perceived interactivity

The system is slow, as it takes a long time for the thumbnails to appear and for documents to open (Perceived interactivity). One recommendation was to replace the computers in the Outpatients department with faster computers, which will help speed up system use during patient consultations.

5.5.8 Image

The majority of informants did not attribute any prestige to using the system. One informant stated that there is some prestige, as other administrative roles do not get to handle patient records or come in direct contact with patients.

5.5.9 Other

The informants offered up some additional feedback, which included the need to consult with ward Sisters before introducing systems or making changes as they understand the ward processes better than anyone else. There was an assertion that the Sisters were never engaged by the project team during the design and implementation. There was an assertion that needing to use the electronic system and patient purple folder together is not practical, and it would be far better to either use a folder with paper notes or an electronic system but not both. As there are now many systems in use, such as for ordering blood tests and viewing diagnostics images, a recommendation was made to consolidate systems in the future, as opposed to adding more systems, as switching between systems is time-consuming.

5.6 Results of the Analysis of Categories, based on the Dimensions Impacted

The approach taken with the qualitative analysis was to gain specific insight into the system acceptance from stakeholders (McDuffie and Scruggs 2008). The benefit of this approach was to gain a far more profound and richer understanding of the responses provided in the survey questionnaire. The questionnaire leveraged a 7-point Likert-type scale, which provides an ordinal value, but no explanation or reason for the value. Feedback from stakeholders provided valuable insight into the meaning behind the survey responses. The understanding gained from the responses confirmed that a problem exists and also provided explanations for the constructs in the proposed conceptual model.

The qualitative research through the engagement of stakeholders has provided much insight. Aligning the insight from qualitative research with the quantitative analysis provides a natural way to interpret the answers to the survey questions. The alignment directly led to a more meaningful understanding of the level of acceptance of the system and the factors that influence acceptance. From an AR perspective, using qualitative research to understand the reason behind the responses provides an opportunity to analyse the issue and to create actionable knowledge. The following categories are used to summarise the insight gained from the research, and the sources are summarised in table 5.6:-

I. The system is a replacement for the patient folders, the paper-based medical record. Access to the medical record is essential for patient care. The need to access the medical record was consistent among the stakeholders. The explanation relates to the Intention to use questions in the survey and provides the reasoning behind the mean score of 3.84 with SD of 1.6 attained. Medical record keeping and having the necessary information available when giving care is essential (Pirkle et al. 2012; Bates et al. 2003), and so the intention to use the system amongst clinical staff should be much higher. From the qualitative analysis, feedback such as not enough computers, searching is not possible and documents not appearing for two weeks would no doubt deter end-users from using the system. Knowing that staff would have to use the system to conduct their day job was an original concept agreed by the RAG. The related literature discusses mandatory system use, asserting that in such environments it is difficult to understand what end-users think about the system (Hwang et al. 2016). As this research combines insight from stakeholders, it helps to avoid such limitations, exposing a deeper understanding that can be used to plan action.

II. Management and colleagues endorse the use of the system, but there appears to be no enforcement. Manager and peer pressure had limited support among the stakeholders. The explanation relates to the Subjective norm questions in the survey and provides the reasoning behind the mean score of 3.46 with an SD of 1.68 attained. The pressure that managers

place on staff and staff place on each other to use the EDM system as part of day-to-day activities was expected to be much higher, and so it is likely that management is not enforcing the mandatory use of the system. From the qualitative analysis, it is clear there is some management enforcement for medical secretaries but not with the other job functions. In a related study, it was found that the influence of others will affect the intention to use the system (Wills et al. 2008). Mandatory use of the system can be introduced through a staff consultation process; however as senior roles experience the same system issues as the junior roles, it is likely that the senior roles do not think it is worth enforcing until some of the system issues are fixed, such as searching. The subjective norm concept was sourced from the TAM2 literature (Venkatesh and Davis 2000), it was discussed by the RAG and initially accepted as significant factor.

III. The lack of a print function, excess blank pages, and a weak search function is an area of concern raised by the stakeholders during the qualitative analysis. The explanation relates to the Output Quality questions in the survey and provides the reasoning behind the mean score of 3.16 with SD of 1.55 attained. It is now clear to see that there are areas where the system does not meet end-user expectations. Some of this may be resolvable through better communications, and areas such as searching needs to be improved. There was no specific expectation by the RAG of how this would be scored, however, what the score represents is the need for software quality assurance and testing, as asserted by Cia et al. (2000). Quality assurance is an area where my practice has changed, whereby project plans now include a product quality assurance review. Using such a technique would mean that issues get identified in testing and resolved prior to launch.

IV. Concerns relating to the speed of the system. Such issues were consistent among the stakeholder responses, whereby they state that the system hangs while rendering the document thumbnails on the screen. The explanation relates to the Perceived interactivity questions in the survey and provides the reasoning behind the mean score of 3.32 with SD of 1.63 attained. The concept of perceived interactivity was sourced from the

literature (Ha and James 1989). Such a finding that a new system is slow to use is quite significant and is now an area where my practice has changed. On new projects, I now ensure that contracts include system performance expectations and I now benchmark against the contractual performance during the testing phase under load, which is a recommendation by Jiang and Hassan (2015). It is worth noting that speed issues could occur from several reasons outside of the system, such as network performance and computer performance.

V. The timeliness of scanned documents. Such issues were consistent among the stakeholder responses, whereby they may have to wait for two weeks to view a required document. The explanation relates to the timeliness of information, which relates to the Perceived usefulness questions in the survey and provides some reasoning behind the mean score of 3.73 with SD of 1.57 attained. The original source of this concept was the Davis (1989) TAM study, with Perceived Usefulness being agreed by the RAG as fundamental to technology acceptance. Such a finding was unexpected as the scanning contract has an agreed service level from when the document is sent away to when it is available in EDM. A RAG hunch was that documents are being stored on the wards and clinics and not sent away in a timely fashion. Further investigation was recommended.

VI. There were concerns relating to a lack of computers on the wards. These issues were consistent among the stakeholder responses. The explanation relates to the Perceived resources questions in the survey and provides partial support or the mean score of 3.69 with SD of 1.71 attained. The concept of resource constraints was sourced from RAG discussions and is consistent with other TAM studies. Having adequate computers with an appropriate specification is essential to accessing electronic records, which is often overlooked in many NHS hospitals (Mulla 2015). My practice has changed as a result of this finding. The project team did not audit what equipment was available and did not provide any recommendations. Going forward, my team now engage with clinical leadership to determine if computers are available before procuring new systems. The cost of all required computers is now included in the business case along with the

software solution, which ensures the NHS hospital is fully aware of the total cost of ownership.

VII. Using the system, in general, was not seen as prestigious, which was consistent among the stakeholder responses. The main reason behind this is that the majority of staff have access to the system and need to use it to conduct day to day activities. Prestige directly relates to the Image questions in the survey and provides strong support behind the mean score of 2.9 with an SD of 1.53 attained. The concept came from the RAG, who had a hunch that those that use the clinical system had more prestige over others. Prestige is also present in several other TAM studies but unfortunately in this case, it was not seen to be a strong influencer.

VIII. System training uptake was minimal, which was a consistent message from all stakeholders. Users have taught themselves how to use the system; however, there was an assertion that the system should be intuitive. The explanation relates to the Training questions in the survey and provides the reasoning behind the mean score of 3.27 and SD of 1.77. As demonstrated in the conceptual model, there is also a strong link with Perceived ease of use, providing the reasoning behind the mean score of 3.62 with an SD of 1.63 attained. Brittain (1989) identified the need for robust IT training amongst NHS staff as they were being exposed to more systems. The RAG was keen to promote this concept, which is also supported by the literature. A significant issue here is that for reasons unknown, staff are reluctant to attend classroom training. Being self-taught may mean that the system is not used appropriately. It is also not an unreasonable expectation from patients that all NHS staff are trained to use the systems that are required for their care. A change in my practice is publishing training uptake figures as part of the project governance process, whereby too low a figure means that it would be unsafe to launch the system.

IX. Possible benefits for the environment. Stakeholders offered up reduced printing as a benefit to the environment. As the research study did not consider perceived environmental benefits, no related constructs appear

in the conceptual model for this and no related literature review was undertaken. The environmental benefits represent an opportunity to enhance the model further through future research. Several searches for TAM models using a perceived environmental benefit construct were undertaken, but none found.

X. Stakeholders posited that there was a lack of stakeholder engagement during the product selection and configuration phases, which would have avoided some of the system issues. While stakeholder engagement was not measured by the survey instrument, the qualitative research brought to light limitations and a lack of engagement by the project team with the broader end-user group. Limited stakeholder engagement has led to the implementation of impractical processes. Two such examples came to light, including the need for the electronic history and recent paper record to be used on the ward together and the need for multiple electronic systems in the clinic rooms. This realisation offers essential understanding that must transfer to future projects. What this finding has highlighted is that the design and configuration project stages were flawed as no actual end-users took part, leading to poor processes. Subsequently, my practice has changed as I now enlist end-users to configure the system with supplier support, and my team oversee the activity. The concept of stakeholder engagement is supported by the literature, whereby there is a need to engage stakeholders from all user communities and at every stage of the technology implementation, as asserted by Bondarouk et al. (2009).

Category	Source
Intention to use	RAG
Subjective norm	Literature
Output quality	RAG
Perceived interactivity	Literature
Perceived usefulness	Literature
Perceived resources	RAG
Prestige	RAG
Training	RAG
Environment	Stakeholders
Stakeholder engagement	Stakeholders

Table 5.6 Sources

5.7 Reflection

Conducting the stakeholder interviews was a rewarding process, it was also challenging as I was playing a dual role with a bias towards my research activities. The interviews brought to life what was visible in the quantitative analysis, providing comprehensive knowledge, such as explanations relating to problems, performance and resources. Using this insight, the RAG was able to make recommendations and plan improvements, which are documented in Chapter 6. Without such insight, it would have been hard to plan meaningful improvements. There is a compelling need to let the outcome of this AR cycle hit home before the effects of the action can be fully understood, as asserted by List (2006). On reflection, conducting this research study has changed my practice by enabling me to bring together a comprehensive set of research methods and apply them so that effective action can be planned. Historically, I would only adopt a single approach, such as grounded theory, a method that poses a question and develops the research around it (Strauss and Corbin 1997). I can now see that a single method may provide clues but not necessarily provide enough to plan action, persuading me to continue to utilise a hybrid method in the future.

5.8 Chapter conclusion

Chapter 5 described how I implemented the O'Leary (2004) AR methodology to analyse the problem and gain sufficient understanding to increase the technology acceptance of the EDM system. An integral part of my approach involved leveraging the combined experience of the RAG to help understand the factors that influence the attitudes and behaviours of staff towards technology acceptance in the NHS hospitals. The factors that were identified were represented as constructs in an extended TAM model that was validated through quantitative analysis and robust statistical techniques. As with all other TAM models, the final model can be used to accurately predict and measure technology acceptance in the NHS hospitals. By combining the quantitative analysis with qualitative analysis, a more profound understanding of the business problem was gained, which was an approach recommended by Harper (2013); Johnson and Onwuegbuzie (2004).

CHAPTER 6 CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

6.1 Chapter Introduction

Chapter 6 brings together the findings from the analysis stage of the AR cycle. Based on the convergence of evidence from the qualitative and quantitative research, recommendations for improvement were possible. Furthermore, action was taken to improve the technology acceptance of the EDM system which is documented in this chapter. The outcomes of the research are also reviewed and discussed. Using scholarly practice and leveraging prior research, this research has extended TAM theory to accurately predict and measure technology acceptance in the NHS hospitals. The new knowledge is of benefit to public managers, end-users and system vendors, enabling such communities to increase the benefits realised through technology investment. The creation of meaningful measures was one of the fundamental purposes of TAM, as asserted by Davis (1989) and this research brings to the forefront tested constructs that are applicable to the NHS hospitals, which may also be valuable to the broader healthcare industry.

6.2 Research Aims Achievement

Using tested constructs from prior research, such as the Davis (1989) TAM model, the intention to use the EDM system was measured via a purpose-built questionnaire using a 7-point Likert-type scale. A sample of 261 end-users involved with patient care responded. The responses to intention to use was analysed, providing a reliability measure using Cronbach's Alpha α of 0.98 and a mean of 3.8 with a Standard Deviation of 1.6. Based on the fact that use of the system is mandatory for healthcare professionals, the expectation was a more positive response towards the intention to use. The finding confirms that the current level of acceptance of the EDM system presents a significant problem to focus on. Through the implementation of AR, the objectives of this research study have been achieved and are summarised as follows: -

- Confirmation that there are issues with technology acceptance of the EDM system as set out in the problem introduced in Chapter 3.
- Selection of TAM as being a meaningful theory to assess technology acceptance, which is described in Chapter 3.
- Detailed analysis of the business problem using quantitative and qualitative analysis, synthesising knowledge from both methods, as documented in Chapters 4 and 5.
- Created actionable knowledge by determining the factors that influence technology acceptance in the NHS hospitals, including the creation of a thoroughly tested extended TAM model as illustrated in Chapter 4.
- Utilised AR to implement action that improves the technology acceptance of the EDM system, which is described in this chapter.

6.3 Planning

The in-depth analysis of the business problem required an extensive search and analysis of prior research, which is included in the literature review contained in Chapter 3. The TAM theory pioneered by Davis (1989) formed the basis for creating a conceptual model to measure technology acceptance in the NHS hospitals. The starting constructs for the conceptual model were Perceived usefulness, Perceived ease of use and Intention to use, all tested through prior research by Davis (1989). The RAG used their experience and observations to promote additional constructs. The conceptual model was then extended to benefit from newer releases of TAM that tested similar beliefs to the RAG, which included constructs from the Venkatesh and Davis (2000) TAM2 model, such as Image, Subjective norm and Output quality. Further extensions to the conceptual model incorporated constructs from other researchers that successfully independently modified TAM, which also aligned to the beliefs of the RAG. Such extensions included a Training construct, as tested by Amoako-Gyampah and Salam (2004) in their extended TAM model. The Training construct demonstrated a significant positive effect of Training on Perceived ease of use. A further extension to the conceptual model came from Cheng-Hsin (2009), who brings into play the concept of resources, such as access to computers, which was a strong constraint recognised by the RAG. Finally, the construct Perceived interactivity as tested by Joon (2016) complimented the conceptual model, which

measures the effect of system performance, such as the speed of access. The conceptual model was thoroughly tested. As documented in Chapter 4, convergent validity and discriminant validity tests took place on the survey data, yielding a high validity. Reliability tests also took place, which confirmed high reliability. Statistical analysis was used to analyse the paths and test the hypothesis. Many of the paths in the conceptual model were supported, however, it was a surprise to see that not all constructs were supported, which conflicted with the belief of the RAG. The Perceived interactivity construct was removed from the model as it was found not to have a positive effect on the Intention to use, making it meaningless in the NHS hospital use case. Figure 6.3 below depicts the final model developed by this research.

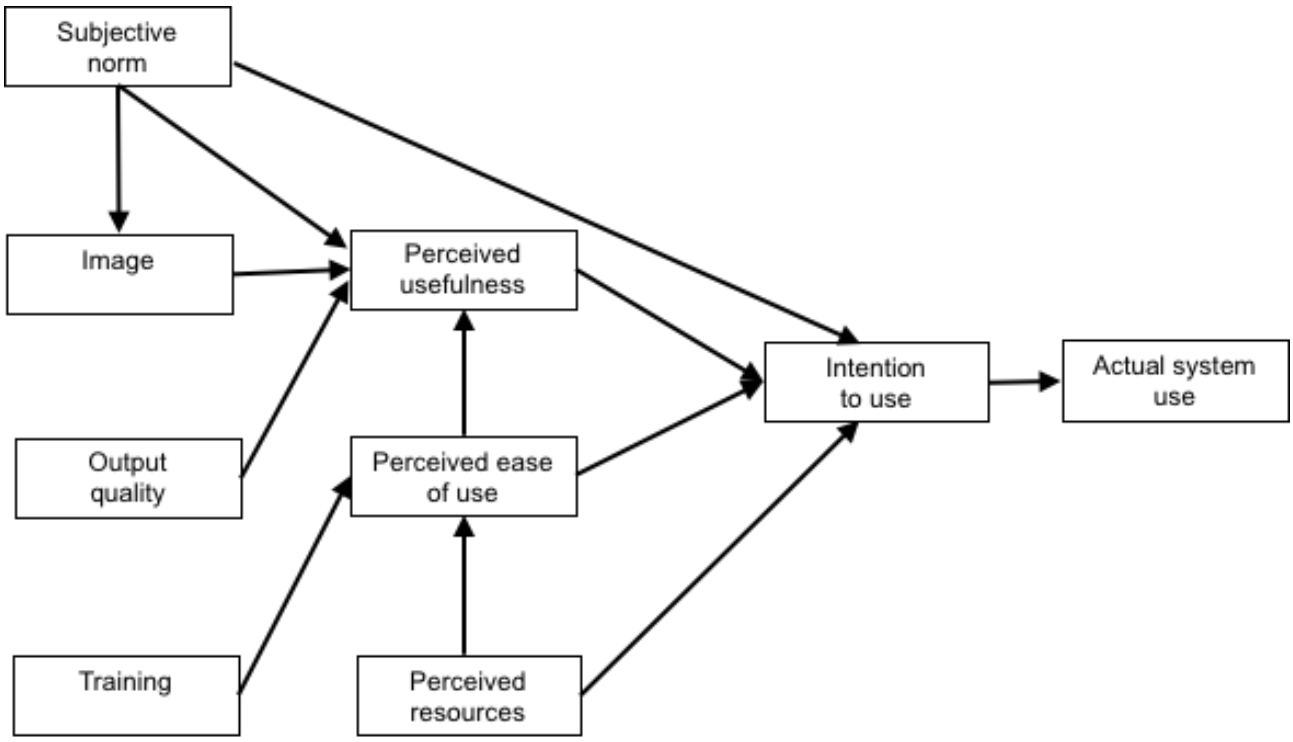

Figure 6.3 Final model

Qualitative analysis also took place and the findings synthesised with the quantitative analysis. The hybrid approach has led to the creation of actionable knowledge, that will provide benefits to technology acceptance through targeted action, as it provides a thorough understanding of the factors that influence technology acceptance in the NHS hospitals.

6.3.1 Planning

The hybrid research approach enabled acceptance issues to be readily identified, quantified and more easily understood. Information gathered from the survey was combined with insight from the stakeholders and grouped by theme for RAG discussion. The rich information allowed the RAG draw on their experience to recommend improvements. For example, by understanding the importance of training and its strong relationship on the intention to use but limited training uptake posited by stakeholders, the RAG set about devising better training approaches. By understanding the factors that influence technology acceptance in the NHS hospitals, it became possible for the RAG to make evidence-based recommendations and target action. Using such an approach enables the realisation of the forecasted benefits described in the business case. As the EDM implementation team had disbanded and support was limited, action fell to the RAG to drive improvement. The RAG discussed recommendations and categorised them in terms of importance, time frame and effort. The RAG settled on several recommendations, which if implemented successfully, would have a direct positive effect on technology acceptance of the EDM system. The improvements were as follows: -

6.3.1.1 Improve the system output

Output quality yielded a lower than expected score from the survey instrument, having a mean score of 3.16 with an SD of 1.155. The estimated path coefficient between Output quality and Perceived usefulness did not demonstrate a positive effect and is not supported, as indicated in Table 4.4.9. The system is basically being used irrespective of the output quality and is more likely being driven by the perceived usefulness. The RAG confirmed that printing had been intentionally disabled so that only a single electronic record is available and so the RAG did not see the need to challenge this. Further investment in enhancing the EDM system by suppressing blank pages and improving the searchability of documents to generate the required output is worth considering but may require a considerable financial investment. In doing so, improvements in Output quality will have a more positive effect on Perceived usefulness and in turn Intention to use. From experience, Output quality is essential, as it represents the functions of the system, whereby poor output quality translates to a weak system and so

minimal benefits realisation. Such a finding was a surprise for the RAG, as what has been proven here is that despite such issues, the system is still being used and these types of issues should have been revealed during system testing. The RAG prioritised this as a medium priority, with an improvement timeframe of three months. The RAG rationale for this was that it would take time to figure what is wrong with the system, however fixing it will be of benefit.

6.3.1.2 Address computer availability on the wards

Concerns were raised relating to the availability and lack of computers on the wards. Not being able to access a computer directly impacts system adoption and technology acceptance. No computer means no access to the system. Perceived resources yielded a mean score of 3.69 with an SD of 1.71 from the survey instrument. The estimated path coefficient between Perceived resources and Intention to use demonstrated a positive effect, as indicated in Table 4.4.9. The estimated path coefficient between Perceived resources and Perceived ease of use demonstrated a positive effect, as indicated in Table 4.4.9. A review of the number of computers available to the wards, the location and type of computer, such as fixed desktop, mobile tablet and workstations on wheels was strongly recommended. The goal should be to make more computers available during ward rounds and to locate computers where clinical staff need access to the electronic patient record. A review of the performance of computers located in the outpatient departments was recommended. Once the audit completes, it is highly likely that further investments in IT hardware are required. Replacing obsolete computers and providing additional computers will remove the obstacles to using the system. In doing so, improvements in Perceived resources will have a more positive effect on Perceived usefulness and in turn, Intention to use. Such a finding was not a surprise, as vast infrastructures such as hospitals often have poor performing and obsolete computers, as asserted by Gayle et al. (2017), which we occasionally see when visiting departments. The RAG gave this a high priority, with an improvement timeframe of one month. The RAG rationale was that resources represented the root cause of the technology acceptance issue and that having better access to computers would definitely increase the intention to use the system.

6.3.1.3 Reduce the time take to get new material into the system

During the qualitative research, delays to recently created documents appearing the system resounded, a phenomenon that directly relates to the usefulness of the system. The system is of less value if the patient record is not up to date and the Perceived usefulness construct is used to measure this. Perceived Usefulness yielded a mean score of 3.73 with an SD of 1.57 from the survey instrument. The estimated path coefficient between Perceived usefulness and Intention to Use demonstrated a positive effect, as indicated in Table 4.4.9. To reduce the time taken for new material to appear in EDM system, it is advisable to study how long the process takes and where the delays are. A time and motion study were recommended for this. It is also advisable to review the contractual Service Level Agreements (SLA) with the relevant collection and document scanning companies. Once fully understood, improvements to in Perceived usefulness will have a direct positive effect on Intention to use. In large hospitals, it is often difficult to track down medical records, which can sit in cabinets, in drawers and on desks for days without being found. Greater responsibility must be placed on staff to ensure that records are sent for scanning in a timely fashion. It was recommended that this activity be combined with item 6.3.1.5, leveraging management and peers. Such a finding was a surprise for the RAG as the expectation was that documents would be collected daily at the end of the clinic and on the same day that a patient is discharged. The scanning turnaround time would be a contractual arrangement, completing within three business days. Document scanning services typically run like clockwork. The RAG deemed this as a high priority, with an improvement timeframe of one month. The RAG rationale was that there would be a significant benefit in understanding where the delays stemmed from and correcting it.

6.3.1.4 Provide more accessible training

There was limited system training uptake, with reports of users teaching themselves. While using the electronic system was judged not to be complicated and was designed to be simple, attending training would transfer to the end-user the intended ways to use the system. Training is also an excellent place to receive tips, advice and guidance. In the absence of training, bad practice or unintended outcomes could occur, such as not being able to search appropriately, or taking longer to perform simple tasks. Furthermore, in areas where staff undertake on the job training, poorly trained staff proliferate bad practice and inappropriate system use. Training yielded a mean score of 3.27 with an SD of 1.77 from the survey instrument. The estimated path coefficient between Training and Perceived ease of use demonstrated a significant positive effect, as indicated in Table 4.4.9. The estimated path coefficient between Perceived ease of use and Intention to use demonstrated a weak positive effect, as indicated in Table 4.4.9. It was recommended that system tutorials be created and made available on the system access page and to promote their use. Do so would help mitigate the issues of end-users not attending the classroom training sessions. Another recommendation was to deliver a short training session for staff during staff inductions, which would help proliferate best practice. Some further investment may be necessary in order to generate training materials and tutorials. The recommendations set out improvements that enable Training to have a more positive effect on Perceived ease of use and in turn, Intention to use. Such a finding was not a surprise for the RAG, as it transpired that training was an area that the project team overlooked. The main reason being that IT professionals found the system easy to use, so did not think that it was necessary. On reflection, this was found not to be the case with end-users who have less IT experience. The RAG determined this to be a medium priority, with a timeframe of three months. The RAG rationale was that while training is important, the end-users seem to be content with training each other and sufficient time should be set aside to create new training materials.

6.3.1.5 Leverage management and peers

There is evidence suggesting that management endorse the use of the system, but it became clear that the use of the system is not enforced. There were good examples of peers also encouraging the use of the system by providing on the job training and these champion users are encouraged through the AR activities. The Subjective norm yielded a mean score of 3.46, with an SD of 1.68 from the survey instrument. The estimated path coefficient between Subjective norm and Intention to use demonstrated a positive effect, as indicated in Table 4.4.9. Subjective norm demonstrated a strong positive effect on Image, as indicated in Table 4.4.9. It was recommended that ways are found to raise awareness and further promote positive re-enforcement from peers, supervisors and managers, such as establishing focus groups and staff appraisals. If implemented internally, there should be minimal cost. In doing so, improvements in Subjective norm will have a more positive effect on Intention to use. Another recommendation to tackle this was to use the system itself to determine who has not accessed the system within a reasonable time frame, using a naming and shaming type of approach. Such a finding was a surprise, as the RAG assumed that staff would insist on using the system and would encourage others. The RAG determined this to be a medium priority, with a timeframe of three months. The RAG rationale was that it would take time to develop an engagement plan with senior stakeholders, which in turn would enable the re-enforcement of system use.

6.3.1.6 Improve stakeholder engagement

The research study did not investigate the processes undertaken by the project team to implement the EDM system. No review of the system design or end-user participation took place as part of this research. The qualitative research revealed that some of the standard operating procedures were now more cumbersome and less workable than before, such as on the inpatient wards. The example provided during the stakeholder interviews described the need to review both the electronic record and a paper record to get the full picture, and there is a need to review multiple electronic systems while in clinic. There was an assertion that such a practice would have been avoidable if stakeholders were involved during product selection and configuration stages. Mathieson (1991)

asserts that systems designed and implemented with end-user participation will better match the requirements, then those systems designed solely by IT professionals. While the EDM product now forms part of business as usual, it was recommended that a user group be created to help with stakeholder engagement. Such engagement could offer a way of ensuring that future product upgrades and further investment offer value and solve existing business problems. Such a finding was a surprise as the RAG assumed that end-users would take part in the requirements, design and testing stages during implementation. The RAG determined this activity to be medium priority, with an improvement window of three months. The RAG rationale was that it takes time to get a user group established and that other activities such as computer access should be the focus.

6.3.1.7 Improve the speed of the system

There were concerns relating to the speed of the system. Perceived Interactivity yielded a mean score of 3.3 with an SD of 1.6 from the survey instrument. The estimated path coefficient between Perceived Interactivity and Intention to Use did not demonstrate a positive effect, as indicated in Table 4.4.9. As such, the Perceived Interactivity construct was removed from the conceptual model. While it is likely that the difference in construct relationships in the Yoon (2016) model, which includes an Attitude construct may have led to this, it is also clear that other factors, such as access to computers (Perceived resources) and system functionality (Output quality) had a far more significant bearing on the intention to use the system. Also, I posit that the usefulness of the system and gaining access to the patient record outweighs the performance of the system. Notwithstanding, increasing the performance of the system, including speeding up the display of document thumbnails would improve the overall end-user experience. At a minimum, the system should be made to perform consistently at the expected speed set by the manufacturer. The RAG was not surprised by this finding, as hospitals have lots of end-users and data, which places a significant demand on the IT infrastructure, however, new systems typically perform well at first and then gradually get slower over time, as more data is added, which is not the case here. The RAG therefore gave improving the performance a low priority, with a timeframe of six months. The RAG rationale was that the conceptual model did not demonstrate computer response times as

being related to the intention to use the system, and so while it does make sense to improve, it was not urgent.

6.3.1.8 Improve the image and prestige associated with electronic records

Image yielded the lowest scores from the survey instrument, having a mean score of 2.9 with an SD of 1.53. The estimated path coefficient between Image and Perceived usefulness demonstrated a positive effect, as indicated in Table 4.4.9. According to the feedback received, reviewing and updating the patient medical record is essential and invaluable to the patient's wellbeing. As such, staff that can undertake such activities should view this as being a crucial contribution to patient care. It was therefore recommended that improved messaging and marketing of electronic patient records commence to all appropriate staff and if implemented internally, this need not be expensive. In doing so, improvements in Image will have a more positive effect on Perceived usefulness and in turn, Intention to use. There RAG was expecting Image to rate high as a factor that influence technology acceptance and so this finding was disappointing. The RAG therefore deemed this as a low priority, with a timeframe of six months. The rationale was that if improvements were made in the higher priority areas as indicated earlier, then Image would improve by itself.

6.3.1.9 Investigate the benefits to the environment

The possibility of environmental benefits came as a surprise from the stakeholder interviews. The RAG did not consider the relationship between environmental benefits and attitudes towards using the system. The qualitative analysis has brought to light a new assumption, that people's strong beliefs relating to safeguarding the environment may also have a positive effect on the intention to use the system. Hostager et al. (1998) assert that there is a causal relationship between motivation and environmental opportunities. As this was not explored in this research, the impact on the environment represents a valuable opportunity for future research. The RAG spent time reflecting on this and I spent time researching environment constructs, but concluded that combining this with the conceptual model at this late stage would be too challenging. Therefore, a future study would be better placed to understand the effect the environment has on the attitude towards using the system.

6.4 Action and observation

As this research study leverages the O'leary (2004) AR approach, which includes an Act stage, the RAG implemented several improvements. One of the constraints that the RAG worked within was that there was no budget set-aside for improvements, such as purchasing additional computers. It is also worth noting that as the project team had disbanded and only limited technical support was available, it fell to the RAG to deliver the improvements, which were as follows: -

6.4.1 Improve the system output – recommendation 6.3.1.1 – High priority

The RAG investigated concerns relating to blank pages and the issues searching documents, which were both found to be reproduceable. Surprisingly, the inclusion of blank pages was by design, which is because the original paper-based record included blank pages. Including the blanks ensured that the electronic record matched the paper-based record 100%, making the electronic version fully admissible as evidence in a court of law. After making further enquiries, the supplier demonstrated a feature whereby pages with little content were suppressible. E.g. blank pages are considered to have 5% or less content. Using this feature to suppress blank pages is being evaluated. In terms of the searchability, it was found that this is improving with time, as newly scanned material has the appropriate meta-data and textual overlay applied. What this means is that new documents are indexed for searching and are fully searchable. Legacy documents, the documents scanned before launching the system, will not be searchable and have to be scrolled through to find meaningful information. It was discovered that the decision not to include the meta-data for legacy documents was a procurement stage decision. The inclusion of meta-data would be a manual process at the point of scanning, which would have a significant implication on cost. The explanation now forms part of the staff system training.

6.4.2 Address computer availability – recommendation 6.3.1.2 – High priority

The RAG investigated the availability of computers by observing the computer usage in busy inpatient wards. While cost was an obstacle, the RAG managed to improve the situation at no cost. The number of non-allocated fixed desktop computers in a typical ward environment varies between two and four. Allocated computers have a designated user or purpose, such as for the ward clerks and ward pharmacists. A non-allocated computer is a general use computer. Increasing the number of non-allocated fixed desktop computers is challenging owing to space constraints. In addition to the fixed desktop computers, computers on wheels as depicted in Figure 6.4.2.1 and Mobile Clinical Assistant (MCA) handheld tablet devices as depicted in Figure 6.4.2.2 are also used for specific applications, such as Electronic Prescribing and Medicines Management (EPMA) and electronic requesting. Typically, wards will have two to six mobile devices. Historically, the Pharmacy and Pathology departments have insisted that the mobile devices are used solely for their specific electronic applications, which is an obstacle, however after further negotiating, these devices were modified to allow access to the EDM system, and a dedicated icon to access EDM has been placed on the desktop. As these devices are mobile by design, an additional benefit is being able to view the electronic patient record alongside the patient. While the intention was for the RAG to complete this in one month, it took three months, as in addition to agreeing on the solution, the technical support team needed to deploy changes to the devices. Anecdotal feedback from end-users has been positive, especially when discussing the positive difference that computers on wheels have made. The MCA's hand-held devices did not work out as well, with end-users stating that owing to a much smaller screen, it was challenging to make use of the EDM thumbnails. Follow-up observations of computers in the busy areas did not demonstrate any significant improvement, with computer availability still being minimal.

Figure 6.4.2.1 Computer on wheels

Figure 6.4.2.2 MCA tablet computer

6.4.3 Reduce the time take to get new material into the system – recommendation 6.3.1.3 – High priority

The RAG investigated the time taken from document collection to when the document is available in the system. The RAG observed that each day Monday to Friday, document folders were collected by medical records staff and batched up for scanning collection. Collection by the scanning company would take place daily Monday to Friday around 3pm. Documents not batched up by 3pm would be saved for the next pickup, typically twenty-four hours later. Once collected, it was found that documents would appear in the system within three working days and no longer than six working days. It was determined that the scanning service was efficient and reliable. After further observations, it was accepted that the practice in outpatients was adequate, with all records being collected daily, however, not with the inpatient wards. Some wards were found to hold on to records past the discharge date of the patient. Anecdotal evidence included obstacles such as clerking and audit requirements, which the RAG determined to be unreliable, as not all wards delay the collection of records. The RAG combined this finding with action 6.4.4 by including information on the recommended records handling procedure. The overall analysis did complete within one month.

6.4.4 Provide more accessible training – recommendation 6.3.1.4 – Medium priority

As a quick and no cost win, the RAG created new and improved electronic learning (eLearning) material, which was posted on the intranet alongside the link to the EDM system, making it far more accessible. The eLearning was developed to demonstrate the common usage of the system and takes less than fifteen minutes to complete. The eLearning provides a tutorial on the paper records handling procedure, how to access the system, how to select a patient, and how to perform a search for relevant material. An additional 1:1 session with an IT trainer can also be booked, and a brief introduction to the electronic patient record system is now provided for new staff on their clinical induction day. Anecdotal feedback relating to the e-learning training has been positive, especially in cases where temporary locum staff arrive at short notice and need to use the system straight away. The RAG considered if there were more scientific ways of measuring the improvement and determined that a new survey should be constructed in the future, which would focus on a training needs analysis for multiple systems.

6.4.5 Leverage management and peers – recommendation 6.3.1.5 – Medium priority

The RAG put together a programme to garner further support for the electronic patient record system with influential clinicians and senior staff, recruiting them as champions. As part of this process, the champion is provided with a 1:1 training session, detailing the intended use of the system and what the current limitations are. The underlying theory with this approach is that users form beliefs about the system that can be influenced by others (Dos Santos 1991) through mechanisms such as training (Amoako-Gyampah and Salam 2004). Sharing knowledge and experience enable both parties to present a consistent message about the system for all end-users and for more champion role models to be recruited. A significant obstacle experienced with this approach is that it is time-consuming, with only twenty champions trained within three months. Despite this, the RAG believes that it is far better to recruit champions who can work with their local end-user community to facilitate greater technology acceptance, which is also an approach supported by Turner and Turner (2002).

Anecdotal feedback from the champions relating to the system has been positive, and some end-users are also able to identify their local champion, which is a positive step. The RAG considered ways of measuring this improvement but found it difficult to agree, as there are so many factors to consider, for example how busy is the champion and how large is their local end-user community?

6.4.6 Improve stakeholder engagement – recommendation 6.3.1.6 – Medium priority

The RAG investigated the issues around stakeholder engagement, which were also found to be true. While there were specific project team engagement sessions in the form of workshops running prior to implementation, it was discovered that the workshops were just product demonstrations. After reviewing the approach taken by the project team, it became clear that no end-users took part in the design or configuration of the EDM system. The EDM project did not learn from the mistakes of other projects, with stakeholder engagement being a significant issue (McManus and Wood-Harper 2007). In addition, there is no real assurance that the system meets the end-user requirements, giving rise to the claims of Mathieson (1991) relating to usefulness and failure. There was an attempt to establish a steering group for the EDM system, which floundered owing to difficulties in scheduling the events. Second time around, with RAG support, an end-user led group of active participants finally launched. The group meets quarterly during the lunch break, with the goal supporting stakeholders to improve technology acceptance in functional areas and helping each other. I attended the first meeting as part of my research role and anecdotal feedback from the stakeholders that attended was positive. The RAG determined that owing to the nature of such a community, it would take a long time to see the benefits, giving rise to a future survey one year on.

6.4.7 Improve the speed of the system – recommendation 6.3.1.7 – Low priority

The RAG investigated the concerns that the system is slow, primarily when it generates the document thumbnails, which are miniature versions of the front page of each document in the patient record. After several observation sessions, it was determined that if the patient record has many documents, it does take sixty seconds or more to render the thumbnails on the screen, and the system is inaccessible during this time. It was agreed that anecdotal feedback of the delays causing frustration should be accepted as being reliable. The manufacturer's initial response was for the hospitals to replace their computers with new faster computers, which would be a significant cost obstacle, however, this was investigated further, and the system upgraded whereby the performance significantly improved. The improvement was measured using a stop watch, which clearly demonstrated sub ten second display times. The process to get the upgrade completed took a little over six months. Anecdotal feedback from end-users concurred with the timing tests, whereby they agreed that the system was noticeably faster.

6.4.8 Improve the image and prestige associated with using electronic records – recommendation 6.3.1.8 – Low priority

The RAG reflected on this and determined that it was better to allow time for the champion process described in section 6.4.5 to bed in, which may increase the prestige associated with using the system. As such, no further action was taken by the RAG.

6.4.9 Investigate the benefits to the environment – recommendation 6.3.1.9 - No priority

The RAG took no further action.

6.5. Research Conclusions

The application of TAM in my practice has demonstrated that it is an accurate predictor of technology acceptance, maintaining its status as a robust and powerful predictor of technology acceptance (Nistor and Haymann 2010). Such insight includes confirmation that technology acceptance of the EDM system is not maximised. The limited acceptance may also have an impact on staff performance and patient care, as relevant information stored electronically may not be referenced (Poon et al. 2010). Such problems centred around equipment availability, training, functionality, content and searchability, which appear as factors in many other TAM studies. All of these factors were expressed by the RAG as being potential factors relating to technology acceptance. As such, these factors were not a surprise and confirmed the value that the RAG brings from its experience. The beliefs of the RAG were presented as constructs in a purpose-built extended TAM model which was validated using statistical analysis. Meaningful measures are now possible, along with a greater understanding of the factors that influence technology acceptance in the NHS hospitals, which is a fundamental purpose of TAM (Davis 1989). By converging evidence obtained from the quantitative and qualitative analysis, recommendations were made, and action taken to improve technology acceptance of the EDM system at the NHS hospitals. Anecdotal feedback was gained from end-users indicating that there were notable improvements in system performance and that more people were starting to adopt the system. Using the O'Leary (2004) AR approach, the next step would be to invoke another AR cycle, commencing with an Observe stage to measure the extent of the improvements and the survey instrument that was created for the first AR cycle could be re-used. Further Plan and Act stages could follow to introduce further improvements. Performing the additional cycle would add value from a confirmatory standpoint. Timing-wise, another AR stage could commence three to six months after the completion of the previous AR cycle, in keeping with the need to let sufficient time pass so that changes bed in (Doherty et al. 2012). Conducting a further cycle would take several more months, taking me beyond the maximum period allowed, however, there is a now a new strategic direction which would ultimately lead to the retirement of the EDM system. Such systems have been superseded, as there is now a requirement for structured data to be

used in Artificial Intelligence (AI) and Machine Learning (ML) applications. The newer applications use data to diagnose patient medical conditions, freeing up clinical staff to work on the interventions, providing improvements to care, as asserted by Clifton et al. (2012). My new remit is to implement electronic patient record systems that capture structured data at source, which has become a priority.

6.6 Implications

Understanding the factors that influence technology acceptance provides excellent insight for many groups, including public managers, technology suppliers and researchers. For me, as a public manager who provides technology solutions, this knowledge is invaluable as it enables me to effectively plan improvements, which is a crucial goal of extended TAM, as asserted by Venkatesh and Bala (2008). Having completed this research, I now know where to apply more focus, enabling me to avoid technology acceptance issues when implementing future similar projects, such as by paying more attention to training, usability, useful content, sufficient technology and quality assurance. It is fair to say that my practice has matured in several ways, which include leveraging existing theory and extending RAG invitations beyond IT staff to include end-users and stakeholders. I am now far more comfortable with encouraging participation from people outside of my regular professional network. Knowing why healthcare technology projects fail and combining this knowledge with factors that influence technology acceptance creates valuable knowledge for sharing. What I have created is a model specific to the NHS hospitals that can be used by others with a similar contextual setting. Researchers in different settings can also use this research as theoretical scaffolding, extending it provide accurate measures in their environment.

My most powerful realisation is that healthcare projects would be more successful if theory backed research takes place before purchasing the system, during the implementation and one or two years afterwards. Achieving significant levels of technology acceptance will deliver measurable benefits back to healthcare, as asserted by Tsu and Shane (2004), which include reduced delays and significant cost avoidance. Providing practical ways of measuring technology acceptance forms the basis of my future research.

6.7 Limitations of this research study

While research study has been extensive, the following limitations are recognised: -

- This study demonstrates a learning journey and a first attempt to apply the DBA learning to a business problem. The study has provided exposure to new concepts and themes, of which an experienced researcher may perform differently.

- This study is a point in time study. The phenomenon analysed is the post-implementation of an electronic system. This study differs from longitudinal studies that use measurements taken at different times, typically before and after the system is implemented.

- Exhaustive searches took place for TAM studies focusing on the NHS. After reviewing limited results, this study appears to be the most exhaustive TAM study for NHS hospitals to consider extending for their needs.

- There is a primary reliance on the views and opinions expressed by the research participants. As such, this study accepts these views as being representative of their profession.

- The qualitative research participants mentioned environmental considerations; however, the environmental benefits were never considered by the RAG and so did not feature in the conceptual model.

- Issues relating to project team engagement with stakeholders were exposed during the qualitative research. No extensive review of the activity undertaken by stakeholders or the project team took place. Such issues were not explored and provide an opportunity for future research.

6.8 Chapter Conclusion

Completing research in the workplace was enlightening, as I learned much about the actual use of the EDM system and the associated issues. I actually gained far more insight from this technology related research project than all others that I have previously led. I now have a far greater understanding of the lens that end-users see-through, whereby they struggle to find available computers that perform adequately and attempt to use systems without formal training. I believe that this knowledge has come as a direct benefit of using a hybrid approach, leveraging AR as the primary research method, as it is known to provide indepth knowledge (Jogulu and Pansiri 2011) and leads to the creation of actionable knowledge (Julnes and Rog 2009). The qualitative research findings presented explanations to support the quantitative analysis, which helped to identify appropriate action. The insight gained from this research positively identifies factors that impact technology acceptance in the NHS hospitals, such as training and system performance. The new knowledge was used to promote action that would improve technology acceptance in my practice. In addition to me, public managers, IT leaders and other researchers can use this knowledge on future similar NHS hospital IT projects to improve success and derive more significant benefit from technology investment. There is an assertion amongst researchers that there is no optimal TAM model for use in healthcare (Rahimi et al. 2018), however, I believe that the TAM model developed by this research demonstrates significant progress.

CHAPTER 7 REFLECTION AND LEARNING AS AN ACTION PRACTITIONER

7.1 Chapter Introduction

Chapter 7 represents the final chapter and serves as a reflective account of the thesis and the DBA Programme. The challenges that I faced are discussed in detail, along with my aspirations.

7.2 Reflections on the Entire Research Project

Much has been accomplished by my use of scholarly methods inside the NHS hospitals, and far more than expected, as tangible improvements have been implemented. Using AR cycles, I learned to look deeper into the hospitals, gaining an understanding of the business problems that they face. An invaluable insight came from understanding how a worker within the system can use knowledge, experience, time and personal development to make a positive difference in solving these problems (McKernan 1996). The literature review led to an expansion of my learning horizons, which was through being exposed to new theories, such as TAM and Gamification theory. By applying action learning and leveraging my professional network, I was able to establish the RAG, creating a collaborative environment for problem-solving (Pedler 2008; Baskerville 1999). As part of the literature review, a significant number of TAM studies were analysed to gain insight from their use of different constructs, and the constructs that aligned with the views of the RAG were included in a conceptual model, which represents the causal relationships between constructs that affect technology acceptance. Through the creation of a survey questionnaire that used a 7-point Likert-type scale, an ethical and efficient data collection stage took place. Using accepted statistical methods, checks to confirm the validity of the constructs achieved a high level of convergent and divergent validity. By further leveraging statistics and making use of Cronbach's alpha, a test of the integrity of the constructs achieved a high level of reliability. A successful test of the conceptual model was conducted by analysing the estimated path coefficient, testing each hypothesis. The majority of constructs demonstrated a direct or indirect effect on the Intention to use the EDM system.

The Perceived interactivity construct, as tested by Yoon (2016), was the only construct removed from the conceptual model as it demonstrated limited influence on the intention to use the system. The resulting TAM model can now be used to accurately measure and predict technology acceptance, matching the beliefs of Davis (1989). Through the use of the conceptual model, I was able to demonstrate that the technology acceptance of the EDM system was limited. There was a realisation that the qualitative analysis provided real-life justifications to what the quantitative analysis had revealed, allowing recommendations to be formed to improve the level of acceptance of the EDM system. Performing this comprehensive research study has demonstrated my ability to use evidence-based approaches to improve the operating environment. Having completed this research provides me with the confidence to go out and do it again, which has led to a personal transformation, increasing my confidence and advancing my practice to include scholarly methods.

7.2.1 My Biggest Challenges

Creating the thesis was, without doubt, the most challenging thing that I have ever done and the most significant piece of work that I have ever created. The thesis write-up has been a massive undertaking, with time management representing the biggest challenge, consuming entire days, nights, evenings and weekends, especially the past six months, which has been constant. There was a need to take on board feedback from my thesis supervisors and to update the thesis accordingly, which massively expanded my knowledge. The next biggest challenge was the need to learn about the relevant theories and commit to a single theory. Making the wrong decision would involve starting over. I was grateful for the support my thesis supervisor provided me when making the decision to adopt TAM, of which I believe this research clearly demonstrates was the right choice. Another challenge was dealing with my dual of role. Being a technology transformation leader and researching a technology related problem created a real challenge for me. Firstly, I needed to take a step back and not propose an immediate solution. There was a need for me employ structured methods over gut feeling and use the analysis to determine the actions. I was also mindful that as a researcher my relationship with colleagues is different and I needed colleagues to understand this as much as I needed too. This was important when conducting the quantitative analysis but more so when working

with the RAG. There was a need for me not to take the lead but to be guided by the RAG. I now believe that experience is what guides a good researcher and so over time, I should be able to get the right balance between roles when researching from the inside. There was also a constant need for me to learn and then immediately apply, as was the case with the AR methodology. Learning how to undertake statistical analysis and using specialist products designed to support quantitative research such as SPSS (Pallant 2007) was also a challenge from an experience standpoint. What became apparent was that once broken down into smaller tasks, this was easily achievable. Furthermore, there was a need for me to understand how to maintain rigour in social sciences research and not to fall in to trap of generalising findings, as asserted by Cadman (2017), again this is something that is improving with experience. Creating this thesis has been addictive, and it was challenging to know when to stop. What I have realised is that I enjoy learning and interacting with others, and the thesis has enabled me to blend my day job with learning, which combines both of my passions.

7.2.2 What Surprised Me

There were several surprises while undertaking this research study, which included: -

- When choosing a workplace problem to study, initial thoughts were that there would be little choice. After an in-depth review of operational issues with the RAG, several problems came to light, which provided a pleasant dilemma.

- The literature review exposed four theories that are technology-related, which was more than expected. Gamification theory was the most exciting find of all of the theories, and I would like to use Gamification theory in future research to test if it does provide stimulus and motivation.

- The writing-up stage of the thesis has taken much longer than expected. There was a huge underestimation of the amount of time required, and six months was not enough. Feedback on the draft thesis was that it needed restructuring. Subsequently, large sections of the thesis were re-written,

which took a significant amount of time. The rewrite includes many more references to support the assertions and flows much better.

- The research in this thesis does not represent the end but the beginning. My desire is to perform follow-up research to see what insights some of the other accepted theories such as TTF (Goodhue 1995) would bring.

- Not all of the constructs in the model were supported, which demonstrates that experience should not outweigh the need to seek proof. Such a finding provides a valuable lesson for us all.

- The environmental benefits that were raised during the qualitative research was an unexpected surprise. The RAG was solely focusing on issues and obstacles to technology acceptance and had lost sight of the benefits. I have learned from this and in future will keep an open mind.

7.2.3 What Went Well and What Went Less Well

The thesis represents my first structured research project, and so I did not know what to expect, so I strongly believe that it went well. In particular it went well because I was learning all the time, taking it slowly and applying a methodical approach. Notwithstanding, there are aspects of this study that I would like to acknowledge as follows: -

- Motivation
  Conducting research was a massive undertaking, and at times, it became difficult to see the light at the end of the tunnel. Significant operational issues at work made it difficult to choose when to focus on the research, and so I had to seize every opportunity. Family health issues also made setting aside a regular study time challenging, and so much of the write up took place late evening and into the night.

- Literature review
  There are thousands of academic articles available in the online library. Having read well over six hundred of them, the amount of knowledge available is limitless. Much of the literature was intriguing, and each article revealed many threads. Following the threads led to many other journals

and theories. It was challenging to know when to stop researching and what not to include. What I found frustrating was the limited amount of relevant literature returned. My proficiency in searching the online library improved the more that I worked at it.

- Creation of the conceptual model
  The creation of the model was the most enjoyable aspect of the thesis, as it involved reflection, knowledge, and patience. Creating the model involved learning from the literature review, leveraging the RAG and leveraging my experience as an IT practitioner. It was surprising to see that not all of the perceived constructs were supported by the data gathered.

- Quantitative analysis
  Performing quantitative analysis was exciting and rewarding. It went better than expected, as I found an abundance of relevant material to follow. I found producing the questionnaire enjoyable as it required creativity, and I liked leveraging existing TAM studies as it allowed me to apply what I had learned. Initially, the statistical analysis was daunting, as I had no practical experience. Breaking down the analysis into more manageable chunks made this possible, along with lots of practice with tools including SPSS. What was surprising was that one construct needed removing from the conceptual model, as it failed to demonstrate a positive effect. In doing so, I realised the power of quantitative analysis over gut feeling.

7.2.4 Personal Assumptions and Values Influencing the Research

From the outset of the programme, my epistemological position aligned with the positivist paradigm. The positivist paradigm is described by Kuhn (1962) as being the pursuit of truth and the use of science to provide absolute proof. Coming from a scientific background, this understanding was welcome, and I get great comfort from applying a formula as a solution, rather than writing an explanation that is subject to different interpretation. Undertaking the “Management Research: Quantitative and Qualitative Methods” taught module was extremely rewarding for me, as it demonstrated the limitations in just explaining the “what”, which does not necessarily lead to actionable knowledge.

By also gaining an understanding of the “why”, the whole picture can be reflected and permanent solutions provided. As such, for the first time, I became comfortable with the concept of combining research methods. During the thesis, as part of conducting qualitative research, the power behind qualitative analysis methods became apparent. The quantitative aspect of the research had revealed what the current situation was but provided no explanation and so on its own, would lead to limited actionable knowledge. The qualitative part of the research enabled engagement with stakeholders to gain far more profound insight. It became clearer to see why the current situation is how it is and potentially what needed to change. Qualitative research provides the ability to focus on specific issues (Easterby-Smith et al. 2013), which helps lead to actionable knowledge. As such, through completing this thesis, my epistemological position has now changed to the interpretivist camp. Having tried both the quantitative and qualitative approaches side by side in this thesis, I now see the need to observe the phenomenon directly through the eyes of the actors, as asserted by Macionis and Gerber (2011). As this research study took place from inside the NHS hospitals, there was a need to put aside my knowledge of technology and working practice. Setting this knowledge aside was to ensure that time went in to listening and responding to what was surrounding me. The other point worth noting is that being a researcher on the inside and working with the RAG relied heavily upon working collaboratively, as recommended by Jenkins and White (1994).

7.3 Reflections on Each Step of the Research Project

As with all technology projects, it is crucial to record lessons learned, so that knowledge can influence future experiences (Nelson 2007). As such, much time was spent reflecting on the AR cycles. The most useful lessons included: -

7.3.1 First stage - Thesis Research

Performing background research was genuinely enlightening, and my biggest challenge was determining when to stop researching. Using the online library, searches for relevant literature returned crumbs that would lead to more literature. By way of example, researching information systems theory retrieved literature relating to many theories. As much of the material was fascinating, it

was easy to lose focus and to start investigating each theory instead of furthering solutions to the business problem. What was enjoyable was that I was not just researching technology acceptance, but I was also learning more about the NHS hospitals, including the documented challenges and issues that it had experienced with IT projects. It is fair to say that the learning was not just theoretical but also practical and readily applicable, such as the insight relating to IT training and the need to learn lessons from other projects (Duffield and Whitty 2015, Newell et al. 2006), which has changed my practice.

7.3.2 Second stage – Survey, and Action Learning Set – RAG

The quantitative research centred around preparing the questionnaire, which I found fun, as it allowed me to be creative. My initial thoughts were to use self-authored questions for information gathering, but the outcome would be a set of knowledge that was not robustly tested and therefore, would not stand up to peer review. As the goal of the quantitative research was to test the conceptual model, a more traditional approach to the questionnaire creation was required. After conducting additional research in qualitative research and validating models, it became evident that the best way forward would be to utilise the same questions that other researchers had used to test their constructs, an approach agreed by my thesis supervisor. In following the same approach taken by other researches, the posited arguments were well supported, as the questions asked in the survey must also directly relate to the constructs that require testing (Royce 1963). As part of my ethical approach, I clearly identified the source of each question used in the questionnaire and also ensured that the data collection, processing and destruction activities were carried out precisely. The survey required the use of a seven-point Likert-type scale, a universally accepted method used for survey responses (Lee et al. 2002). The use of the Seven-point version as a best fit over three-point, and five-point scales was agreed by the Thesis Supervisor, along with the sample size and overall approach. The questions asked for each construct were all drawn from prior research, including questions from Davis (1989) relating to the Perceived ease of use and Perceived usefulness constructs. Leveraging my skills honed over many years in data processing, codifying the responses into values for analysis (Malone et al. 2017) was also straight forward. The survey data was analysed using the SPSS software package, specially purchased for this study. Performing the

quantitative analysis was really interesting, and there is so much support available for statistical analysis, including detailed tutorials on YouTube and so this was easier than initially expected. After reading many TAM related articles, a decision was made to analyse and present the findings in the same way as typical TAM studies, including model validation.

Reflecting on the Action Learning Set (RAG), creating it was a gratifying process. The most significant benefit was the diversity in opinions, which increased our productivity, in keeping with the assertion of Eckel and Grossman (2005). Distilling these ideas down to constructs and then referring to prior research was a time-consuming process that involved reviewing a significant amount of literature. What was also evident was that we all fell back on our areas of expertise. For example, RAG members with training experience asserted that training had a significant influence on technology acceptance. The RAG determined that factors such as training, subjective norm, resources and image all have a bearing on perceived ease of use, which was supported by existing research. These themes were built into the conceptual model and validated. Utilising the RAG made the AR cycle enjoyable and mutually beneficial, which improved the learning experience, as asserted by Benware and Deci (1984); Koo (1999).

7.3.3 Third stage – Writing thesis

Writing the thesis presented the most significant challenge for me of all time. There was a significant underestimate of the complexity and amount of time required for the write-up. Assessing the level of detail required was the root cause of this, with many reviews and corrections needing to be applied. The original structure adopted for the thesis was not granular enough and so further reviews and support from the thesis supervisors led to the creation of the final massively improved structure. Furthermore, my writing skills significantly advanced since I commenced the write-up, which resulted in me rewriting the original chapters. My writing skill has improved immensely, which is another area that benefits my practice. In hindsight, possessing better writing skills would have proved useful throughout my career as a manager and leader. The underpinning of my assertions required citing literature to promote the most persuasive arguments and so there was a need to ensure that everything

obtained from external sources was correctly cited, in accordance with good practice.

7.4 Future Research

Would I conduct more research? Absolutely yes. Producing this thesis has provided me with much insight and confidence, and I have already identified several future research opportunities, which would help the workplace and also extend the existing body of knowledge. Through this research study, I now have a valuable TAM model that is relevant to my practice. The conceptual model provides an accurate way of measuring technology acceptance in the NHS. Where this comes in to play is with benefits realisation, which is an industry term used to reflect the point at which value is achieved (Bradley 2016). With technology investments, technology acceptance is a significant benefit to realise, as not using the system represents waste, as asserted by Venkatesh and Davis (2000). My intention is to use the conceptual model on the technology transformation programme that I am currently working on. The transformation programme will bring in to service a new electronic patient record system that will remove all paper and will capture structured data electronically at the point of care, through electronic forms and systems integration to medical devices that monitor vital signs. The NHS is now implementing AI, ML and decision support routines, allowing conditions that doctors miss to be quickly identified (Goldhahn et al. 2018). These routines require a significant amount of patient activity data so that they can learn to positively identify patterns, adapt and advise. I believe that this is an area which could benefit significantly from me applying the DBA scholarly practice, as it requires a structured research approach. My thoughts would be to perform a longitudinal study for the EPR system implementation, using the conceptual model to measure the technology acceptance at critical points throughout the implementation. I would also like to combine this with AR and introduce several cycles to ensure that benefits are realised. The use of an iterative approach is a benefit of AR, which increases research rigour (Kock et al. 1997) and using an evidence-based approach will provide the programme stakeholders with assurance.

Now that I have gained real research experience, I am keen to try and blend my TAM model with some of the existing theories that I researched. My thoughts

were to extend the model further using the Goodhue (1995) TTF, to understand if the appropriate technology was being applied to the right business process, as considered by Dishaw and Strong (1999). Combining methods would involve the creation of an integrated conceptual model, which would introduce task-technology-fit as a construct, as proposed by Sik et al. (2018). In doing so, the influence that task-technology-fit has on Perceived ease of use and Perceived usefulness in the NHS could be understood. I would also like to explore the effects of combining the TAM principles in my TAM model with gamification, to improve the user experience and increase acceptance rates at the same time (Codish and Ravid 2014). The TAM model for the NHS hospitals is a significant outcome of this research study, and my belief is that this model can offer insight to others that will guide future technology implementations and to remediate issues with acceptance of existing systems. Such an outcome is a benefit of the DBA approach, which is designed to create actionable knowledge for operational managers through a work-based learning approach (Soten 2016). To this end, I am keen to extend the model further by adding constructs relating to the environment and stakeholder engagement, both of which surfaced during the qualitative analysis. Another area to explore would be factors arising from centrally delivered IT solutions, such as from the SSC model versus locally delivered, as no constructs that measure this could be found.

The reasons why NHS IT projects fail is an area that also warrants further investigation and is useful knowledge for those in my profession. The lack of stakeholder trust is one reason why many such IT projects do not improve patient safety, as asserted by Justinia (2017). Observations in my practice also provide many other possible reasons, such as a lack of commercial awareness, as asserted by (Watson 2001). Currently, there is much opinion on why healthcare projects fail, which include scale (Kreps and Richardson 2007) and Governance (Patel and Robinsion 2010), but the use of accepted research methods in this area appears to be very limited (Yarbrough and Smith 2007), so this study provides a unique contribution to healthcare.

7.5 Research conclusion

Chapter 7 closes this research and provides a reflection on the outcomes. A tangible outcome is an extended TAM model, which I will use in my practice and also share with others. The model can sit alongside the other TAM models and can be extended by others for their exact need, in keeping with the beliefs of Davis (1989). An additional outcome from this research is a richer understanding of the factors that influence technology acceptance in NHS hospitals, which go beyond the extended TAM model to include stakeholder engagement, the SCC technology delivery structure and financial performance, all of which represents areas for future research. Such knowledge is invaluable to public managers as it provides them with an opportunity to act sooner with the intention of avoiding failure. The most significant outcome for me is that despite being an experienced practitioner, performing this research has immensely changed my practice. A significant change is that I now approach problems by performing background research, seeking out methodologies and scholarly practice of how others have approached similar problems. I tend to use Google Scholar for this as its readily available in my workplace. I also find that learning lessons from others not only saves time on my projects but also prevents mistakes (Duffield and Whitty 2015). When I write board papers, I now describe situations both quantitively and qualitatively, combining facts with narration to provide a more profound meaning. The new approach leads to fewer questions and fewer revisions. When implementing projects, I now adopt a more inclusive approach, working beyond IT experts to include clinicians and end-users, ensuring that the views of stakeholders are heard across all project stages, as recommended by McManus and Wood-Harper (2007). Leveraging specific research from this study, I now also recruit champion users, staff from the business that can encourage and promote the use of the system, leveraging the Subjective-norm construct that I exposed in this study. I also now pay far more attention to measuring the numbers of end-users trained and encourage local training within departments by champion end-users, leveraging the Training construct from the TAM model. Most of all, I can now ask how do I know if these approaches are working? Well, to be sure, I can now take the TAM model and apply it to measure technology acceptance accurately. I am currently delivering another large technology

transformation project and intend to put my model to use upon completion in autumn next year.

Before joining the programme, I had spent over twenty-five years in practice, of which the last ten have been at senior manager level, leading teams. Through my practice, I had become accustomed to making decisions and advising others. The choices I used to make were based on gut feeling, what I perceived to be the right choice. Sometimes, the decisions that I made worked out well and other times not so well. Such an approach seemed perfectly reasonable, as when I looked around at peers and superiors, I was merely following the status quo. By applying what I have learned from the programme, I can now see that there is a far better way. I now realise that there is a need to apply critical thinking, along with a compelling need to apply research and knowledge to business problems (Sekaran 2016), paving the way for scholarly practitioners. The term scholarly practitioner provided an entirely new opportunity for me, and ten years ago or more, I would not have been able to expand my thought processes enough to see a need for them. I now see that scholarly practitioners are people that work in the industry, they apply a blend of experience and theoretical knowledge, bringing together scholarly methods to solve business problems, as asserted by Bourgeois (2010). I assert that scholarly practitioners manage as leaders and use evidence-based approaches to solve business problems, guaranteeing success. I now realise that in undertaking the thesis, I have not been operating as a regular staff member, as I have finally started to behave as a scholarly practitioner, benefiting from critical reflection.

Early on in the DBA programme, the Doctoral Practitioner module introduced essential concepts, including the need to reflect critically during situations (Raelin 2003). Critical reflection is an extension of critical thinking; it entails thinking about practice and then stepping back and asking self-probing questions, as asserted by Murray and Kujundzic (2005). It took a while to get used to this approach, as my typical response was to jump in with both feet. During the thesis, there were many times when critical reflection was applied, for example when evaluating which business problem to choose, I believe it is one method that has made the research a valuable piece of work. It is fair to say that I have been applying these concepts ever since. The first realisation was

understanding that personal learning and organisational learning are intrinsically linked (Tickle 2005). While both can happen in isolation, it is far more beneficial to apply both together. My thesis is an excellent example of this, as while it has been an educational journey, it has also directly contributed to improvements in the workplace. Ultimately, such an approach has changed my view on work-based problems, as I am now able to apply critical reflection, an essential technique for scholarly practitioners that is rewarding when used (Gardner 2009). As such, I now no longer see problems, just puzzles. Puzzles are solvable and have one or more suitable solutions (Edmonstone 2003), and I now believe that this is the benefit that a scholarly practitioner brings. Using structured approaches such as AR was new to me, especially when combined with the creation of knowledge through mode two learning, the bringing together of multi-disciplined teams for short periods to solve problems (Gibbons et al. 1994). Having used AR to undertake this research and having completed the "Action Research and The Action Research Thesis module", I now see that I was wrong. The work of Coghlan and Brannick (2010) has helped me see that AR is a living process which can offer continual improvement. AR is well-aligned to business environments as they also do not intend to end and need to keep providing solutions until there are no more business problems. With AR, there is often a requirement for local knowledge to provide an understanding of processes, people and problems. As such, AR lends itself better to an enquiry from the inside situation (Brannick and Coghlan 2007). Enquiry from the inside leads to the creation of specific knowledge, and the researcher must be aware of their attachments and biases (Evered and Louis 1981). Understanding how researchers influence situations is an area where critical reflection has helped throughout the thesis process, as there was a need to ensure that I remained genuinely impartial, which provided me with the ability to challenge assumptions (Rigg and Trehan 2004) without fear of reprisal.

The DBA programme and especially the thesis has led to a positive change in me, both inside and outside the workplace. I commenced the programme as an apprehensive but experienced practitioner, having the belief that I possess excellent analytical skills. The DBA programme has guided me through a supported journey, topping up my knowledge and enhancing my approach with the use of scholarly methods. The DBA programme and thesis has shown me

that I am capable of using scholarly techniques to help practice. The DBA programme has improved my confidence in the workplace, as I now feel that the decisions I make are genuinely better as the knowledge and experience of others reinforces them, which is a technique I learnt from the literature review. Having thought that the learning journey ends with the completion of the thesis, I now realise that it marks the beginning and I now have the confidence to conduct research on a larger scale to tackle future business problems. In closing, I am eternally grateful to the University of Liverpool, my thesis supervisors, examiners and faculty members, as what I have learned through the DBA programme will continue to support my career and personal life for the rest of my days.

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Appendix A – Action Learning set notes

Summary of topics discussed: -

Operational & technology problems

1. Electronic document Management (EDM) – What does it do?

   Web based computer systems that contains scanned images of paper based medical records (eg: Appointment letters, consultation letters, diagnostics, discharge summaries). – Replaces the medical record.

2. The rich picture

3. Anecdotal feedback: -
   System slow
   System difficult to use
   No access
   No enough computers
   Can't find notes
   System not being used

4. **Discussion: -**
   Wrong product, can it be swapped?
   What alternative systems are there (is the data elsewhere)?
   What training was provided, class room or e-learning
   Is there a user forum?
   How can you tell if the system slow?
   How do documents get into the system?
   How can the situation be approved?
   What happens if nothing is done/no improvements?
   How can we influence the acceptance of technology?
   What's important to end users?

5. For the next meeting?
   Review process work flow
   Review training materials and approach
   Assess system speed/performance
   Bug list/upgrade road map from supplier
   Review suggestions to improve technology acceptance

Appendix B – Survey Instrument

Section	Statement	Strongly disagree	Moderately disagree	Somewhat disagree	Neither disagree or agree	Somewhat agree	Moderately agree	Strongly agree
		1	2	3	4	5	6	7
Intention to use								
	Assuming I have access to EDM, I intend to use it.							
	Given that I have access to EDM, I predict that I would use it.							
Perceived Usefulness								
	Using EDM improves my performance in my job.							
	Using EDM in my job increases my productivity.							
	Using EDM enhances my effectiveness in my job.							
	I find EDM to be useful in my job.							
Perceived Ease of Use								
	My interaction with EDM is clear and understandable.							
	Interacting with EDM does not require a lot of mental effort.							
	I find EDM to be easy to use.							
	I find it easy to get EDM to do what I want it to do.							
Subjective norm								
	People who influence my behaviour think that I would use EDM.							
	People who are important to me think that I should use EDM.							
Image								
	People in the Trust who use EDM have more prestige than those who do not.							
	People in my organisation who use EDM have a high profile.							
	Having EDM is a status symbol in my organisation.							
Output quality								
	The quality of the output I get from EDM is high.							
	I have no problem with the quality of the EDM output.							
Perceived interactivity								
	Access and response speed of EDM is fast.							
	I think EDM's content is useful to me.							
	It is convenient to use EDM at any time.							
	It is convenient to use EDM everywhere.							
Training								
	The kind of training provided to me was complete							
	My level of understanding was substantially improved after going through the training program							
	The training gave me confidence in EDM.							
	The training was of adequate length and detail							
	The trainers were knowledgeable and aided me in my understanding of EDM							
Resources eg: Computers								
	I have the resources I would need to use EDM.							
	There are no barriers to my using EDM.							
	I would be able to use EDM if I wanted to.							
	I have access to the resources I would need to use EDM.							
About the respondent								
	My role is	Admin	Nurse	Non-medical	Medical			
	My gender is	Male	Female					
	Healthcare related experience	<1 year	<10 years	10 to 20yrs	>20 years			

Appendix C – Information and Consent

Committee on Research Ethics

Participant Information Sheet

Factors that influence technology acceptance in healthcare

Version 8.0

Dear Colleague,

I currently work in the I&T department as the Digital Care Transformation Programme Manager and lead on technology-enabled change for the organisation. While we may not have met or corresponded before, you have been selected to participate in this survey as you offer valuable insight into my area of research.

It is my belief that your role within the organisation and your experience brings you into contact with patient-related information systems. Such contact enables you to evaluate the effectiveness of such a system, and I am interested in understanding more about your attitude towards using them.

The data provided by this research will be analysed and used to create actionable knowledge that will be reviewed, reflected on and utilised by a specially assembled learning set. The identities of all survey and learning set participants will not be disclosed during this process.

Nevertheless, should you experience any discomfort or disadvantage by participating in this research you can withdraw at any time without any penalty.

A summary of my findings will be made available to you on request at the end of the research, which is expected to last for one year.

Purpose of the study

The purpose of this research study is to identify and understand the factors that influence the successful adoption of new IT systems in hospitals.

This study aims to expand on existing theories such as the Technology Adoption Model, the assertion that the perceived benefits of new IT systems outweigh the ease of use.

The goal is to create new knowledge that will inform the approach for future IT projects in hospitals within the organisation, increasing the adoption and contributing to their success.

Why have I been chosen to take part?
This survey is being sent to approximately 1000 hospital staff that use the IT systems to gain valuable insight into the factors that surround, influence and encourage the adoption of IT systems. Understanding the attitude for staff towards these systems and how they are implemented will help to create better approaches for future projects.

Do I have to take part?
While your contribution is valuable, your participation in this research is voluntary, and you can choose not to participate. All participants are free to withdraw at any time without explanation and without incurring a disadvantage.

What will happen if I take part?
If you choose to participate, all that is required of you is to answer the questions which should typically take no longer than 30 minutes. However, there is no set time limit.

Is there any compensation or expense reimbursement?
No compensation, rewards or expenses are being offered to participate in this research study.

Risks
There are no perceived disadvantages or risks involved in taking part in this research study as a survey participant or learning set participant and all data collected is anonymised. As the data collected is anonymised, there will be no way of linking back responses to the participant. If the participant should experience any discomfort or disadvantage from participating in this research, you can withdraw at any time.

Are there any benefits in taking part?

All of the responses from participants will be analysed and used to inform future approaches to IT projects. The intention is to make improvements in future IT projects based on understanding the staff better, which should benefit staff.

What if I am unhappy or if there is a problem?
If you are unhappy, or if there is a problem, please feel free to let us know by contacting the researcher. If you remain unhappy or have a complaint which you feel you cannot raise with the researcher, then you should contact the Research Governance Officer at ethics@liv.ac.uk. When contacting the Research Governance Officer, please provide details of the name or description of the study (so that it can be identified), the researcher(s) involved, and the details of the complaint you wish to make."

Will my participation be kept confidential?
Yes, all data collected will be anonymised. As the data collected is anonymised, there will be no way of linking back the responses to the participant. The data will be stored on the primary investigator's laptop in encrypted form and will be

password protected. The data will be stored for five years. The data collected will only be used for this specific project. The learning set will only review summary data that has been anonymised.

What will happen to the results of the study?
The results of the research will form part of the principal investigator's thesis. Only anonymised data will be used. As the data collected is anonymised, there will be no way of linking back the responses to the participant.

What will happen if I want to stop taking part?
Participation is voluntary, and a participant can withdraw at any time and without explanation. Participating in this survey does not waive any legal rights. Results up to the period of withdrawal may be used if you are happy for this to be done. Otherwise, you may request that they are destroyed and no further use is made of them. As all collected data is anonymised data may only be withdrawn before anonymisation.

Who can I contact if I have further questions?
The Principal Investigator is your primary point of contact. The Principal Investigator is Jason Bincalar, who can be reached by email or telephone.

Committee on Research Ethics

PARTICIPANT CONSENT FORM

Title of Research Project: Factors that influence technology acceptance in the NHS

Researcher(s): Jason Bincalar

	Please initial box
I confirm that I have read and have understood the information sheet for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.	
I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason, without my rights being affected. Also, should I not wish to answer any particular question or questions, I am free to decline.	
I understand that, under the Data Protection Act, I can at any time ask for access to the information I provide and I can also request the destruction of that information if I wish.	
I agree to take part in the above study.	

Participant Name	Date	Signature
Jason Bincalar Name of Person taking consent	Date	Signature
Jason Bincalar Researcher	Date	Signature

Principal Investigator:
Name: Jason Bincalar