UNIVERSITY OF OXFORD

Business Case

Project Nexus

Improving Diagnostic Imaging Provision Using a New Joint Venture Business Model

A Proposed Pilot in Coventry & Warwickshire

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Table of Contents

List of Abbreviations ..... **ii**

Lay Summary ..... **iii**

Executive Summary ..... **v**

Chapter 1 | Introduction **1**

1.1 | The Imaging Capacity Deficit 1

1.2 | The Proposal 3

1.3 | The Five Case Model Methodology 5

Chapter 2 | The Strategic Case for Change **6**

2.1 | The Policy Context 6

2.2 | Market Failure and Operational Inefficiency 9

2.3 | Capital Financing Models in the NHS 13

2.4 | Demand & Capacity Analysis 16

Chapter 3 | The Economic Case **23**

3.1 | Options: Longlist 23

3.2 | Options: Shortlist 25

3.3 | Options Appraisal 26

Chapter 4 | The Commercial Case **34**

4.1 | Corporate Structure 34

4.2 | Payment Mechanism 36

4.3 | Risk 37

Chapter 5 | The Financial Case **39**

5.1 | Capital Requirements 39

5.2 | Affordability 40

5.3 | Sensitivity Analysis 41

Chapter 6 | The Management Case **43**

6.1 | Governance 43

6.2 | Delivery, Risk and Resilience 43

6.3 | Success and Continuity 44

Chapter 7 | Conclusion and Reflections **45**

7.1 | Conclusion 45

7.2 | Personal Reflection 46

7.3 | Conflicts of Interest 47

References **48**

List of Abbreviations

APPG	All-Party Parliamentary Group
BAU	Business As Usual
BCR	Benefit-Cost Ratio
CapEx	Capital Expenditure
CDC	Community Diagnostic Centre
CDEL	Capital Departmental Expenditure Limit
CQC	Care Quality Commission
CSF	Critical Success Factor
CT Scan	Computer Tomography Scan
DHSC	Department for Health and Social Care
DM01	Diagnostics Waiting Times and Activity
FCP	First Contact Practitioner
HWB	Health and Wellbeing Board
ICB	Integrated Care Board
ICS	Integrated Care System
JSNA	Joint Strategic Needs Assessment
JV	Joint Venture
MRI Scan	Magnetic Resonance Imaging Scan
NHS-VMI	NHS and Virginia Mason Institute Partnership
NHSE	National Health Service in England
OECD	Organisation for Economic Co-operation and Development
ONS	Office for National Statistics
OpEx	Operating Expenditure OR Operating Expenses
PDC	Public Dividend Capital
PFI	Private Finance Initiative
PPP	Public Private Partnership
PSNFL	Public Sector Net Financial Liabilities
PVB	Present Value of Benefits
PVC	Present Value of Costs
RCR	Royal College of Radiologists
RDEL	Resource Departmental Expenditure Limit
SCBA	Social Cost Benefit Analysis
SCEA	Social Cost-Effectiveness Analysis
SEP	Strategic Estates Partnership
SRO	Senior Responsible Officer

Lay Summary

Across England, a significant proportion of people are having to wait to have diagnostic tests performed, with many people waiting beyond the government's own target of six weeks. At one point in 2025, approximately 360,000 people were waiting for six weeks or more for such tests. Most of these people were waiting for some form of medical imaging, such as CT scans, MRI scans and ultrasounds.

These figures tell us that something is broken within the healthcare system. For a long while, the NHS has struggled to invest in necessary infrastructure. This is in part because it is a publicly-funded healthcare service which cannot borrow money easily to invest, unlike businesses and people. As such, spending gets prioritised for day-to-day services but rarely for expensive equipment which can serve patients over many years. Consequently, the UK has one of the lowest numbers of CT and MRI scanners per population amongst similarly developed countries. This problem, and a shortage of skilled radiology staff, is predicted to get worse, not better.

For this reason, intervention is necessary. This business case tests a proposal which aims to address the spending constraints of the NHS so that equipment can be sourced without impacting the government's strict budgeting rules. By joining together with a private partner, the NHS can benefit from private money being spent on infrastructure whilst it co-runs a joint service with the. The proposal put forward in this business case is called Project Nexus. This project aims to deliver affordable imaging services at pace so that backlogs are addressed.

In order to test the theory of this model, Project Nexus proposes a pilot in Coventry and Warwickshire, an area that is also affected by imaging delays. This way, if there is success proven here, the project can expand to other parts of England.

In this business case, this proposal is put through a series of tests with each acting like a filter. The concept must first prove it is of importance to society. Then it must demonstrate that it would be of benefit to society. It must also prove that it would not harm the NHS and that it could operate even if challenged. Confirming that this solution is affordable is also part of this evaluation. Finally, the proposal must show how it would be delivered and how it would manage risks along the way.

Having been put through all of these important tests and thoroughly critiqued at each stage, Project Nexus has been able to successfully demonstrate that it is a viable solution to address the imaging delays. It allows the NHS to avoid spending its own money, yet a fully fledged service can start operations one year after final decisions are made and agreements signed. It also allows the NHS to share in profits, something that previous private partnerships have not always supported.

Executive Summary

The Strategic Case for Change

The NHS is experiencing a significant diagnostic imaging capacity deficit. Demand for imaging is showing robust growth, yet infrastructure and workforce capacity remains constrained and is forecast to worsen. NHS capital constraints limit infrastructure spending and this is revealed in benchmark metrics. The UK has one of the lowest rates of CT and MRI scanners per population amongst developed countries. National policy has attempted to address this problem, however, insufficient solutions have failed to have a meaningful impact.

The Proposed Innovation

Project Nexus proposes a joint venture business model which overcomes NHS capital constraints using private capital to kickstart operations and clear imaging backlogs. This project proposes the use of a cost-effective modular architecture to deliver community-based diagnostic care, addressing national and local strategic priorities. Coventry and Warwickshire is proposed as a pilot testbed for scaling.

Feasibility

A thorough evaluation using the gold-standard Five Case Plan demonstrates positive economic value to society (BCR 2.2.), commercial viability for all stakeholders, a realistic capital strategy, robust affordability (69% BEV) and modular construction which can deliver full operations by the end of month 12.

Recommendation

Nexus is considered a viable option. It circumvents bureaucratic capital constraints that prevent necessary spending on infrastructure. It offers a disciplined and risk-limiting approach to a stubborn challenge. The proposal to pilot in a single ICS allows for scalability testing by conducting a post-implementation review.

Chapter 1 | **Introduction**

1.1 | **The Imaging Capacity Deficit**

The NHS in England is facing a significant and persistent problem. In early 2025, approximately 360,000 people were enduring a wait of six weeks or more for diagnostic tests. The vast majority of people were waiting for some form of diagnostic imaging, such as CT or MRI scans (Nuffield Trust, 2025). This is a staggering number of people — equivalent to the entire population of the city of Coventry (ONS, 2025) — held in virtual queues across England. The problem is not showing signs of abating as demand for imaging continues to grow year-on-year, representing a major challenge for the healthcare system. This demand is far outpacing any growth in capacity and the net effect of this is missed targets, dissatisfied patients, and treatment delays (RCR, 2025).

The system's capacity to provide imaging has not always been so stretched. During the 2008-2012 period, less than 1% of patients waited six weeks or more for all imaging investigations as revealed in NHS England's (2025b) monthly Diagnostic Waiting Times and Activity Return (DM01) data. In stark contrast, the DM01 data for late 2025 shows that nearly 20% of patients in England were waiting six weeks or more for an MRI scan or non-obstetric ultrasound. The shortage of critical infrastructure partly explains these delays. A detailed OECD (2023) report revealed that the UK has just 19 CT and MRI scanners per million people, compared to 178 CT and MRI scanners per million people in Japan, and 48 combined scanners per million people for all OECD countries on average. There

may have been an uptick in England since this data was gathered but the gulf between the UK and almost every other OECD country has been sizeable and points to structural issues in the healthcare system.

These issues were examined in 2020 when a detailed review into diagnostic services was undertaken by Professor Sir Mike Richards (2020), often referred to eponymously as the *Richards Review*. A core focus of the review was diagnostic imaging and it offered detailed explanations for the prevailing delays whilst making recommendations to address these. The review's findings can be distilled into three broad categories that explain issues that are still ongoing (RCR, 2025):

- **Operational Inefficiencies:** Concurrent "hot" (emergency) and "cold" (routine) imaging, together with a suboptimal use of technology to facilitate flow and a failure to implement best practice logistics.
- **Resource Constraints:** This applies to a deficiency of trained staff and medical equipment. The relative scarcity of CT scans mentioned above is an example of this.
- **Capital Deadlocks:** The existing NHS funding model makes infrastructure spending very difficult. This is due to highly restrictive and bureaucratic capital expenditure limits. A quote from NHS Confederation's 2025 capital efficiency report aptly summarises this constraint: "Capital expenditure limits are imposed on NHS trusts by HM Treasury that cannot be exceeded, even if the funds to make such investments are available." (NHS Confederation, 2025a).

It is clear that the imaging capacity deficit is not due to any single issue. Instead it is due to the combined effect of several issues which have varying degrees of

connectedness. Any solution must navigate and address these multi-factorial challenges in order to succeed.

1.2 | **The Proposal**

This business case proposes and examines **Project Nexus** (hereafter referred to as "Nexus") as a solution to the imaging capacity deficit outlined above. Nexus proposes modular Community Diagnostic Centres (CDCs) in a distributed network, operating with 'Lean' principles. The premise of Nexus is that a modular network configuration, developed using a joint venture funding model, would provide superior operational performance and better economic and financial sustainability than existing solutions. Widespread distribution and accessibility would also serve community needs. Nexus represents a business model innovation through a combination of the following:

- A unique low cost modular operational design.
- The separation of 'operations' and 'property' into distinct business structures.
- An AI-enhanced algorithm-based workflow to optimise efficiency.

Nexus is a proposed proof-of-concept pilot that would use the Coventry and Warwickshire Integrated Care System (ICS) as a testbed. The imaging delays in this ICS reflect the national picture as demonstrated in granular Trust-level DM01 data (NHS England, 2025b). Analysis of this data leads to a clear finding: imaging capacity is insufficient for demand.

The Coventry and Warwickshire ICS includes the city of Coventry, as well as several towns, such as Rugby, Stratford-upon-Avon and Warwick, and rural areas.

This diversity, together with demographic variation across the area (ONS, 2025) makes it an ideal testbed location for Nexus. If this pilot were to prove successful, Nexus would have the potential to scale nationally.

Nexus aims to address what is in many respects a national challenge that manifests locally. In order to offer a compelling solution, Nexus has the following core investment objectives which intertwine application to the Coventry and Warwickshire ICS footprint together with national relevance:

- **Clinical Objective: Enhance operational performance.**

  The proportion of patients waiting six weeks or more for imaging should be reduced to 1% at one year following operations commencing. This would meet the national target for imaging set by the Department for Health and Social Care (2024).

- **Financial Objective: Overcome existing capital deadlocks.**

  Joint venture partnership would facilitate readily available capital for capital-intensive projects and infrastructure, overcoming a key NHS constraint. This objective requires private capital investment (estimated requirement is £15-20 million) to be secured within the first six month planning phase.

- **Strategic Objective: Validate a scalable model.**

  A post-implementation review at one year following rollout would evaluate the commercial and strategic viability of Nexus' joint venture and modular hub-and-spoke model, helping decision-makers to understand the wider applications to the NHS, including of joint venture adoption in other areas.

1.3 | **The Five Case Model Methodology**

In order to ensure a rigorous business case evaluation and comply with NHS funding rules, the methodology adopted here is the Five Case Model (HM Treasury, 2018b). This methodological framework is essential because NHS capital can only be unlocked if strict procedural rules are followed that comply with HM Treasury guidance. *The Green Book* (HM Treasury, 2022) clearly states that the Five Case Model is the required framework for business case evaluation where public funding is concerned. Given that Nexus is a proposal for a joint venture partnership that includes the NHS, it is essential that this business case adheres to this expected standard.

The Five Case Model requires an evaluation of the strategic, economic, commercial, financial and management cases. Each dimension is explored under its own chapter heading. Chapter 2 is the longest chapter given the depth and breadth it covers.

Chapter 2 | **The Strategic Case for Change**

2.1 | **The Policy Context**

Policy-driven initiatives in recent years have attempted to address imaging capacity constraints. A key change was the introduction of CDCs, which aimed to provide diagnostic services, not limited to imaging, within communities rather than in hospitals. The *Richards Review* (Richards, 2020), which was commissioned by NHS England, kickstarted CDC implementation at scale. It was this review that provided the evidence that underpinned renewed national policy, having been commissioned to support the delivery aims of the 2019 *NHS Long Term Plan* (NHS England, 2019). By October 2020 its recommendations had been accepted by the NHS England Board (Richards et al., 2022).

A year prior to the *Richards Review*, official NHS England policy had shifted with revised aims prioritising greater levels of care provision in communities rather than hospitals (NHS England, 2019). This priority was endorsed again in 2025 by the Department for Health and Social Care (DHSC) in its latest 10 year plan for the NHS in England (as of March 2025, the DHSC has direct control of NHS England) (DHSC, 2025). Reflecting the renewed national policy direction, the *Richards Review* also kept community at the core of its recommendations.

The *Richards Review* brought to the fore the inefficiencies of a mixed use approach of equipment and staff for acute ("hot") inpatient diagnostic services alongside community ("cold") diagnostic services. Richards' terminology can be explained as

follows: “hot” services must dynamically adjust to acute and emergency pressures, often prioritising emergency and inpatient cases; “cold” services do not require dynamic adjustments and are inherently more predictable. Richards was clear that CDCs should be located away from hospital sites, insulating them from “hot” workflows.

Whilst the *Richards Review* deserves praise for its depth and breadth, it appears that Richards’ core recommendations were lost in a long list of 24 summary recommendations. For a policymaker this may have read like an unmanageable list, with some far-reaching individual recommendations such as its ambitious workforce growth targets: 2,000 additional radiologists and 4,000 additional radiographers. Other targets were less specific, such as optimal CDC numbers. Without a clear strategic and business roadmap, policymakers were at risk of misinterpreting and wrongly executing the recommendations made by Richards.

This may explain why a 2024 report published by the All-Party Parliamentary Group (APPG) for Diagnostics, *CDCs Unveiled: Challenged & Triumphs* (APPG, 2024), highlighted that the CDC implementation had within just a few short years experienced funding issues, fair geographical coverage concerns and missed targets for scans. This report also highlighted issues with staffing and the underutilisation of technology. Implementation was not fulfilling Richards’ vision and failed to deliver an effective, technology-led, sustainable CDC programme.

The following examples from the APPG report demonstrate the gulf between the CDC rollout and Richards’ intentions:

- There was significant political pressure to set up CDCs with pace. As a result, they were often set up on hospital sites, using space adjacent to existing buildings or on car parks. Doing so undermined the importance of keeping a clean divide between "hot" and "cold" diagnostic services and the need to bring testing closer to communities. Whilst the report cites an improving shift here, its latest figures still show nearly half (46%) of CDCs being approved are intended to be located on hospital estates.
- Due to ICB budget constraints (capital deadlocks mentioned earlier in section 1.1), the most financially risk averse way of setting up CDCs was chosen. Budgets were scarcely available to develop new infrastructure that could be ideally located for accessibility whilst providing "hot-cold" division.
- There is nothing to suggest that the best technology or best practice logistics were incorporated. Richards did not intend for the same technology and ways of working to be shifted into new light structures (e.g. portable cabins) situated on hospital site car parks, yet it appears that this is exactly what happened.
- Staffing numbers did not grow in tandem with infrastructure. Limited improvements delivered through quicker appointments was not reflected in diagnostic reporting speed. Understandably, it is unrealistic to expect as fast progress here given the length of time it takes to train and recruit specialist staff, therefore this is not necessarily a shortcoming.

In addition to the above, the APPG report states that three years after Richards' recommendations, only 6.5% of NHS total diagnostic activity was taking place in CDCs. Thus, it is reasonable to conclude that the strategic planning and subsequent execution of recent and ongoing initiatives has been far from optimal.

Unfortunately, the problem of imaging delays has been addressed with ill-fitting solutions that fail to sustainably solve the various bottlenecks within the end-to-end imaging workflow. Future solutions must avoid the pitfalls of these sub-optimal approaches. They must not only address the capacity deficit but do so in a way that aligns with Richards's vision. Before considering the solutions (or options) that could achieve this, it is important to consider the problem drivers within the market and capital environments.

2.2 | **Market Failure and Operational Inefficiency**

2.2.1 | **Structural Market Failures**

The persisting imaging capacity delays are a sign of market inefficiency that is itself a product of structural market failures that are pervasive across England (Richards, 2020). Section 1.1 briefly outlined some of the market failures taking place, such as capital deadlocks. In *Healthcare Management*, Moralee et al. (2025) explain how the NHS is a publicly-funded healthcare provider which is taxpayer funded, thus it cannot operate with the flexibilities of a free market enterprise. Without the same capital restrictions as the NHS, businesses can invest in new infrastructure by raising capital, whether through equity or corporate bond issuance, or by securing traditional loans (Ross, Westerfield and Jordan, 2022).

In contrast, the NHS is spending-limited by the Capital Department Expenditure Limit (CDEL). This is a fixed limit set by HM Treasury (2024a) that NHS Trusts are permitted to spend on infrastructure. In essence, the CDEL is a spending cap that prevents the government from being forced to borrow more. Unfunded spending would add to the budget deficit and thus add to the national debt,

breaching the 'Investment Rule'. This rule limits investment spending and is designed to reduce national debt, otherwise known as Public Sector Net Financial Liabilities (PSNFL), as a percentage of GDP. This rule is the key reason for the CDEL (OBR, 2025).

Whilst a given NHS Trust may financially be able to afford capital expenditure (CapEx) for a project, it is likely to be limited by the CDEL. Thus, for investment in necessary or cutting edge healthcare technology and services, the CDEL can act as an uncompromising blocker, as argued by the Institute for Government (2023). All of this creates a capital allocation inefficiency because capital cannot go where it is required and where it may offer a favourable social return. This demonstrates how government spending restrictions, whilst well intentioned, contribute to a market distortion. To overcome the CDEL restriction and address the market failure arising from capital deadlocks, capital often needs to be raised from sources external to the NHS.

An analysis of market failure would be incomplete without recognising the nuanced definition of 'market' used in health economics and public health. In a publicly-funded healthcare system, the market is the patient population being served and the equity underpinning that provision (Culyer, 2001). Therefore, there is a sociological dimension to how market failure is assessed: the fair allocation and distribution of services. The tendency of providers to centralise services to hospital sites for cost or convenience risks resulting in a distributive misallocation of resources. The historical location of radiology services in hospital radiology

departments and the more recent location of CDCs on the same sites is an example of this (APPG, 2024).

The Inverse Care Law (Hart, 1971) explains the inverse correlation between the distribution of healthcare services and their utilisation — a problem that impacts the poorest most. It is therefore critical that healthcare services are easily accessible to those with the greatest need for them. As Marmot et al. (2020) have argued, the conceptual framework underpinning this "law" is no less applicable in more recent times where health inequalities continue to exist. In the *Richards Review*, the persistent issue of health inequity was directly addressed with its unambiguous recommendation to move services to communities. By continuing to develop and locate CDCs on hospital sites, this health-specific market failure is being exacerbated rather than corrected. A focus on delivering widely available and accessible imaging would address this problem.

Having explored key macroeconomic market failures caused by capital allocation constraints and as well as the distribution of resources, it is also important to recognise the microeconomic inefficiencies that exist within the existing system, particularly the impact of concurrent "hot" and "cold" operations as discussed in the previous section.

2.2.1 | **Operational Inefficiency**

As highlighted in the APPG (2024) report, the decision to locate many CDCs on existing hospital sites has not fulfilled Richards' recommendations. Rather, doing so has perpetuated operational conflicts. The failure to effectively separate the "hot" and "cold" workflows means that emergency work risks operating with a negative externality. The clinical priority given to emergency "hot" flows results in the cancellation and delays of routine work, resulting in an operational inefficiency. When resources and staff belong to a common pool, they can be too readily diverted to emergency work, thus negatively impacting routine work. This type of predictable unpredictability is costly and despite some sparse signs of improvements mentioned in the report, the problem largely continues.

In recent years, there have been attempts within the NHS to integrate operational best practices from industries beyond healthcare. One such example is the partnership between the NHS and the Virginia-Mason Institute of Seattle (known as the NHS-VMI partnership). University Hospitals Coventry and Warwickshire NHS Trust was one of five NHS Trusts selected for this partnership. Burgess et al. (2022) evaluated the 'Lean' methodology of the Virginia Mason Production System introduced into these Trusts — an approach which is a "translation" of the Toyota Production System. They found that safety and efficiency improved significantly, especially at UHCW which became one of the most efficient Trusts in England. Since 2023, NHS Impact has become a national strategy to bring continuous improvement into the healthcare system (NHS England, 2023b). In essence, it is scaling the NHS-VMI partnership's successes nationally.

The highly-regarded Toyota Production System is the original source of these evolving systems and strategies which now find their home in healthcare. Liker (2021) explains that Toyota, a manufacturer of highly-reliable vehicles, spent decades refining its production system and culture. It is a system that is designed to enhance continuous learning and prevent foreseeable disruptions to workflow, appreciating the heavy cost of inaction. A streamlined imaging workflow that takes inspiration from this system would help mitigate avoidable delays, enhance predictability and be in alignment with Richards' vision. With key elements of the Toyota philosophy now embedded into existing NHS strategy, there is national strategic support to tackle the ongoing "hot" and "cold" imaging workflow conflict. Burgess et al. (2022) accurately highlight that this can only work if done holistically, not partially.

2.3 | **Capital Financing Models in the NHS**

Attempts have tried to overcome NHS capital constraints with a mixture of success and failure. To allow a more complete appreciation of NHS capital constraints, the following list shows the recognised on Statement of Financial Position funding mechanisms available to Trusts (HMFA, 2023):

- **Internal Funding**

  This funding comes from accumulated surpluses and non-cash depreciation charges. Typically, the amount generated is only enough to spend on maintenance CapEx. The use of any cash is subject to the CDEL.

- **Central Government Funding: Public Dividend Capital (PDC)**

  Strictly this is not a loan but a special instrument available from DHSC. This is

only given when Trusts can prove they have insufficient internal sources of funding. This is interest-bearing and subject to CDEL restrictions.

- **Charitable Donations**

  Specific charities can donate to Trusts and this money can go towards infrastructure with no CDEL restriction. However, the scale of this is typically small.

The above list demonstrates the difficulty Trusts have in raising and more importantly, spending capital. In an attempt to circumvent capital constraints, several types of public-private partnership (PPP) have been utilised over years.

Private Finance Initiative (PFI) was a highly popular form of PPP during the 1990s, 2000s, and even into the 2010s. This mechanism allowed private entities to develop healthcare infrastructure and lease it to the NHS. However, the reputation of PFIs tarnished due to strict terms imposed on NHS Trusts (Keep, 2018). A 2008 National Audit Office report found that PFI-contracted NHS Trusts were typically limited to using the services of the PFI provider, including for basic building alterations (NAO, 2010). With such clauses removing any threat of competition, PFI providers had very effectively established a service monopoly, stripping away any chance of market efficiency. Consequently, PFI costs have added significant amounts to the total payment over the length of contracts, costing taxpayers dearly (Pollock, Price and Liebe, 2011). Since 2018, the PFI model has been abolished and is no longer used to fund new projects (HM Treasury, 2018a).

Despite the controversies of PFI, the call for PPPs has not abated. The NHS Confederation (2025b) has articulated the continued need for NHS and private finance "co-investment" in order to deliver infrastructure and fulfil the healthcare system's long-term strategy. The co-investment advocated by the NHS Confederation is more commonly referred to as a joint venture (it can be referred to by other terms depending on the exact arrangement such as 'Strategic Estates Partnership'). In this business case, the term joint venture (JV) is preferred for its breadth, simplicity and because it is the specific term published in the official and ongoing guidance from HM Treasury (2010).

In the JV model, two or more organisations join in forming a new venture (business), sharing both risks and rewards along the journey. The key benefit of the JV model over structures like PFI is that it is collaborative by design and aligns incentives through shared ownership and profits. Critically, it allows public sector organisations such as the NHS to capture value that would otherwise escape as stated in HM Treasury (2010) guidance. Evidence that this happens is shown in Yeovil District Hospital's (2021) accounts. Here cash has been added to the balance sheet from hospital's profitable JV car park. This would not have been possible with a standard PFI arrangement.

In other global healthcare systems which share similarities with the NHS, similar collaborative PPP models are proving they can deliver healthcare in a way that is sustainable. With terminology and exact commercial and legal structures varying from country to country, different JV models allow private sector capital and expertise to be leveraged in a way that is mutually beneficial to all partners. These

points are echoed in the NHS Confederation report which also examined the different models of JV used globally. Most importantly, the report endorses widespread adoption of the joint venture in the NHS based on evidence of success from similar countries such as Australia and based on the UK's fiscal constraints.

It is clear that the NHS will struggle without private capital given the capital constraints discussed earlier and it is positive that the healthcare system is moving on from PFI. The joint venture funding model has governmental and institutional backing, and is the capital model that the NHS is actively embracing.

2.4 | **Demand & Capacity Analysis**

2.4.1 | **Demand Drivers**

In England, patients waiting six or more weeks for imaging surged to over 50% at the beginning of the COVID-19 pandemic as shown in DM01 filings (NHS England, 2025b). Analysis of this data reveals that six-week waits have reached a new elevated norm, plateauing at 15-20%. The pre-pandemic six-week wait time was approximately 1-4% for all imaging and the existing trend is attributed to a mixture of structural and operational reasons, including weaknesses in the CDC implementation (Freedman and Wolf, 2023). Published literature appears to overlook what is likely to be another important driver of demand: the surge in non-medical practitioners. Shortly before the pandemic, *The NHS Long Term Plan* (2019) introduced a significant policy shift, with the rapid expansion of the First Contact Practitioner (FCP) role to meet demand pressures.

Traditionally, GPs have been the gatekeepers of referrals and imaging requests from the community (Green et al., 2001). However, changes implemented since the 2019 plan have meant that patients are increasingly likely to see FCPs for undifferentiated illnesses, many of whom can now freely make imaging requests (Health Education England, 2021). GPs are inherently medical risk managers who are highly adept at handling diagnostic uncertainty, skills which allow efficient use of limited diagnostic resources. The compressed training pathway for FCPs does not develop the same practicing model. Consequently, the surge in FCPs appears to be a likely demand driver for imaging, yet the implications of this workforce surge remains under-researched.

If such supply-driven demand actually exists, it is separate to, and would amplify, the organic demand growth projected in the *Richards Review*. Richards had found pre-pandemic diagnostic testing demand, including imaging, was growing at 5-7% per year, explained by factors such as ageing population and medical advancements. A more recent publication by the Royal College of Radiologists (2025) found growth for cross-sectioning imaging (CT or MRI) to be higher than this in 2024 at 8%. Adding to the demand pressure is the predicted shortfall of radiologists which the report says could reach almost 40% by 2029.

The demand growth story in the Coventry and Warwickshire ICS reflects Richards' predictions and the national picture. An analysis of the local DM01 data (NHS England, 2025b) shows that imaging demand is growing at approximately 6% per year which is higher than the rate of scanning capacity growth of 2% per year. The net effect of this is demand outgrowing supply. Data

from November 2025 show that 223 people were waiting 13 weeks or more for an MRI at the largest hospital within the ICS, University Hospital in Coventry.

There are reasons to justify growing demand within the ICS, such as the local demography. Coventry, the largest urban centre in the region, is seeing its population steadily increase (ONS, 2025). In contrast, south Warwickshire has an ageing population and even if the population were to remain stable, increasing age-related disease prevalence places additional demand on healthcare services, including imaging. Therefore, the ICS will continue to experience demand growth in different areas but for different reasons.

Furthermore, data from Coventry City Council's (2024) Joint Strategic Needs Assessment (JSNA) reveals a steep socioeconomic gradient across the city, with considerable differences between its wealthiest and poorest wards. Coventry is known as 'Marmot City' because of its collaboration with Sir Michael Marmot and its commitment to tackle inequality is a key pillar of its current Health and Wellbeing Strategy (Coventry HWB, 2023). With so many deprived wards to the north of the city, local healthcare infrastructure must account for volatile and consistent demand. Late presentation of disease, particularly in the emergency setting, is likely to impact emergency ("hot") workflows more, risking the negative externality arising from this. To ensure the city's commendable strategy of improving health inequality is served, imaging must also be accessible.

In summary, the demand for imaging is real and driven by a myriad of causes, including national and local factors. With so many demand drivers, imaging demand has every reason to remain robust.

2.4.2 | **Capacity Constraints**

OECD (2023) data cited in Chapter 1 shows that the UK has a much lower number of CT and MRI scanners per million population compared to most OECD countries (19 per million people in the UK versus 48 for the OECD average). The Coventry and Warwickshire ICS covers a population of 1 million people (ONS, 2025). Local equipment data in Table 2.1 shows that there are a total of 19 CT and MRI scanners serving the ICS population, therefore matching the national rate. If the OECD average is used as an international benchmark, there is clearly a national and local shortage of critical imaging equipment. The UK rate ranks 38th out of 44 countries, 60% below this benchmark.

It may be argued that there are limitations in comparing with other countries because the NHS can operate less equipment with greater efficiency. However, this argument is refuted with the following counter-arguments: most OECD countries also run public healthcare systems; six week waiting rates in England demonstrate persistent inefficiency; and future demand has clear drivers that will exacerbate existing inefficiency without equipment investment.

Within the Coventry and Warwickshire ICS there are two private providers which offer imaging services: The Meriden Hospital (CQC, 2024) and Nuffield Health Warwickshire Hospital (CQC, 2025). Even if the small number of CT (2) and

MRI (2) scanners of these providers could be made available during their downtime for insourcing, it would be impossible to meaningfully address the capacity deficit this way — a point articulated robustly in the *Richards Review*.

Furthermore, the shortage of infrastructure should not be seen as the only constraint. There exists a considerable workforce deficit which benchmarking reveals. The West Midlands (the region the ICS sits within) has 60 radiologists per million people, compared to the UK average of 101 radiologists per million (RCR, 2025) and a European average of 127 radiologists per million (European Society of Radiology, 2024). It is impossible to hire out of this structural capacity deficit given the length of training for radiologists. Only highly efficient solutions that integrate AI offer a chance of solving this deficit with speed.

For equitable healthcare provision, capacity must also consider location of services. Table 2.1 shows the location of CDCs in Coventry and Warwickshire being entirely within hospital sites, with all cross-sectional imaging availability restricted to these locations. The centralisation of imaging on hospital sites will not reduce widespread health inequalities in Coventry and is therefore not in alignment with the city's own Health and Wellbeing Strategy (Coventry HWB, 2023). Better distribution would fulfil local and national strategic priorities.

The data in Table 2.1 was combined and cross-referenced from a mixture of sources with the aim of obtaining accurate and up-to-date data, using information available in the public domain. The sources providing this data were: University Hospital Coventry and Warwickshire Trust (UHCW, 2024a, 2024b, 2024c); South

Warwickshire NHS Foundation Trust (2025); George Eliot NHS Trust (2025); Coventry and Warwickshire ICS (2024); and Horsley Huber Architects (2024). The data shown in Table 2.1 may not reflect the precise current service offering, however, it provides a useful scope of resources available to the 'market' (patients).

Table 2.1: Geographical distribution of current radiology services across Coventry and Warwickshire. For citations, see above.

Geographic Area	Site	Functional Unit & Description	Equipment & Services
North Warwickshire	**George Eliot Hospital**	**Main Radiology Department**	• **MRI:** 1x Fixed • **CT:** 2x Fixed • **X-ray:** 4 DRs • **Mammography**
	George Eliot Hospital	**Warwickshire North CDC**	• **MRI:** 1x Fixed • **CT:** 1x Fixed • **X-ray:** 1 DR • **Ultrasound**
Coventry	**University Hospital**	**Main Radiology Department** The region's tertiary centre and a Major Trauma Centre	• **MRI:** 4 Fixed • **CT:** 4 Fixed • **PET-CT:** 1 Fixed • **Interventional:** 2 Suites • **X-ray:** 6 DR • **Ultrasound:** 9 Rooms
	City of Coventry Health Centre	**Community Radiology Unit**	• **X-ray:** 2 DRs
Rugby	**Hospital of St. Cross**	**Elective Surgical Hub**	• **CT:** 1 Fixed • **X-ray:** 3 DR • **Ultrasound:** 4 Rooms
	Hospital of St. Cross	**Rugby CDC**	• **MRI:** Mobile Unit • Uses hospital CT and ultrasound out of hours.
South Warwickshire	**Warwick Hospital**	**Main Radiology Department**	• **MRI:** 1 Fixed • **CT:** 2 Fixed • **X-ray:** 3 DR • Ultrasound • Mammography
	Stratford Hospital	**South Warwickshire CDC**	• **MRI:** 1 Fixed • **CT:** 1 Fixed • **X-ray:** 1 DR • **Ultrasound:** 3 Rooms
	Leamington Spa Hospital	**Community Radiology Unit**	• **X-ray:** 1 DR • **Ultrasound:** 1 Room
	Ellen Badger Hospital	**Community Hospital** Construction works ongoing	• **X-ray:** 1 PFR
KEY | Blue = "Cold" Site; Red = "Hot" Site; *DR = Digital Room; PFR = Plain Film Room*			



Chapter 3 | **The Economic Case**

3.1 | **Options: Longlist**

This chapter generates and explores potential options that could address the imaging delays discussed earlier. The Five Case Model, as published in *The Green Book* (HM Treasury, 2022), provides the mechanism for option generation. Options are developed and considered during the economic case stage of the framework because public economic value is paramount to option assessment. The critical success factors (CSF) are listed in Table 3.1 and these are used to determine the viability of option choices. The CSFs act as a multi-layer filter for various choices.

Table 3.1: Six CSF used in the options appraisal.

CSF	Description of Requirement
1 **Strategic Fit**	• **Requirement A:** The option must align with the *Richards Review* recommendation of having CDCs with physically separate workflows and the DHSC (2025) *10 Year Health Plan* of delivering greater community-based imaging services. • **Requirement B:** The option must provide accessible imaging and aim to address health inequalities which is a key strategic priority within the ICS.
2 **Business Needs**	• The option must be able to bring six week wait times for all imaging down to 1% or less.
3 **Value for Money**	• The anticipated Net Present Social Value (e.g. improvement in health that allows a quicker return to work) must exceed the economic cost of the option.
4 **Supply Capacity**	• The option must deliver a credible workforce solution (e.g. teleradiology) to address the existing deficit of radiologists.
5 **Potential Affordability**	• The option must be able to start and scale within the existing NHS (ICB) funding limitations (notably CDEL).
6 **Potential Achievability**	• There must be minimal delay to delivery. The option must start operations 12-36 months following a final investment decision.

As set out in detail in *The Green Book*, the CSFs are to be used together with the Options Framework-Filter as part of the longlisting exercise (HM Treasury, 2022). In Table 3.2, a range of option choices within different dimensions is listed and each is filtered through the CSFs in Table 3.1. In the table below, "P" (green) indicates the preferred way, "C" (amber) represents carry forward, and "D" (red) represents a choice discounted at this stage, either because it does not meet the CSF criteria or because it is judged to be an inferior choice.

Table 3.2: The Options-Framework Filter (*represents Business As Usual).

Dimension	Option Choices & Assigned Designation	
A **Service Scope**	**A1.** Provide urgent and emergency imaging only.	D
	A2. Provide restricted pathways for imaging.	D
	A3*. Provide comprehensive imaging (acute and routine).	P
	A4. A3 & Image-based screening for a variety of conditions.	D
B **Service Solution**	**B1.** Upgrade and renew existing imaging equipment as required.	D
	B2. B1 & Develop new equipment within hospital departments.	D
	B3*. B1 & Develop new CDCs on hospital sites only.	D
	B4. B1 & Develop new CDCs across a range of suitable sites.	P
	B5. Combination of all of the above (full spectrum development).	D
C **Service Delivery**	**C1*.** NHS: internally managed and delivered.	C
	C2. Joint venture: NHS and private partnership.	P
	C3. Private delivery with no/limited NHS input.	D
D **Implementation**	**D1.** Phased over 3 or more years.	C
	D2. Phased over 1-2 years.	P
	D3. Big Bang: Immediate, with no phasing.	D
E **Funding**	**E1.** Public Funding (PDC) within CDEL.	C
	E2. Mixed Funding: Public and Private.	D
	E3. Private with service fee (e.g. PFI).	D
	E4. Private with profit-sharing (e.g. JV).	P

3.2 | **Options: Shortlist**

To complete the Options Framework Filter analysis, the longlist of option choices was checked against the CSFs as recommended in *The Green Book*, allowing the shortlisting process to begin. Any choices deemed inferior were rejected at this stage. This process, from establishing CSFs to generating a shortlist options aims to enhance transparency, efficiency and reasoning. However, like any framework, there are limitations and in this case the quality of the inputs determines the range of options that can be generated. Without diligence during inputting, there is a real risk of inferior shortlist options being generated. Another weakness in this framework is its susceptibility to retro-fitting biases. Due consideration was given during this process to ensure a robust shortlist of options was produced.

Following a considered synthesis of option choices marked "P" or "D" in Table 3.2, a shortlist of three options has been formulated. These are:

- **Option 1: Business As Usual**

  This is the status quo.

  Profile: **A3** | **B3** | **C1**

- **Option 2: NHS Internal Model**

  A fully NHS managed and funded comprehensive CDC programme with an anticipated development horizon of up to 3 years.

  Profile: **A3** | **B4** | **C1** | **D1** | **E1**

- **Option 3: Joint Venture Model**

  JV partnership with complete private funding of CDCs and profit-sharing of operations. This option has an anticipated development horizon of 1-2 years.

  Profile: **A3** | **B4** | **C2** | **D2** | **E4**

The Business As Usual (BAU) option is included as a 'control' comparator option, as recommended in *The Green Book*. These options are appraised individually in the following sections, with particular emphasis on areas of difference.

3.3 | Options Appraisal

3.3.1 | Appraisal Outline

Shortlisted options are appraised in line with HM Treasury (2018b: 2022) guidance publications. The aim of the economic appraisal of options is not for an exhaustive comparative analysis but to cross-test options based on qualitative and quantitative economic parameters. The critical first step is the Social Cost Benefit Analysis (SCBA).

3.3.2 | Social Cost Benefit Analysis

For the three options, there is a difference in both benefits and costs. As such, a SCBA is the appropriate economic analysis tool rather than Social Cost-Effective Analysis (SCEA), a decision official guidance supports. The difference in benefits is apparent when comparing the anticipated time to delivery of the non-BAU options. The JV model is expected to deliver benefits much sooner than the NHS model and the SCBA can capture this benefit as it is attributable to time, whereas the SCEA cannot. If more people are receive imaging sooner and for a greater number of years, this is a sure economic benefit to society that should be counted.

As part of the SCBA, the Net Present Social Value (NPSV) is calculated for the shortlisted options using the following formula (in *The Green Book* this is expressed in words rather than as a formula):

NPSV = PVB (Present Value of Benefits) − **PVC** (Present Value of Costs)

In order to calculate the PVB and PVC, several important assumptions are essential. This section provides a rationale for the assumptions made together with a calculation of the NPSV. It is recognised that weak assumptions can result in misleading and erroneous outputs. To mitigate this, special effort is made to justify assumptions and adopt a conservative approach where appropriate. *The Green Book* principles and recommendations are adhered to throughout the SCBA unless otherwise stated.

Table 3.3 provides a comparison of the three shortlisted options. Listed within it are key assumptions and calculated figures for the PVB, PVC, and NPSV (an example of the discounted cash flow calculation is shown in Appendix 1). A 10 year timeframe has been chosen for several reasons: it reflects a realistic minimum contractual length for a JV model; it aligns with the length of long-term NHS plans; and it avoids lengthy forecasting of operating expenses (OpEx) which are subject to fluctuation. This SCBA also assumes that the JV model would commence operations much sooner as private capital can be made available more readily than public sources of funding (NHS Confederation, 2025b).

The Green Book recommends absolute figures be used to compare all options, allowing for a more true assessment of the BAU option, including its benefits. The BAU option has an ongoing OpEx which has been listed as a cost that can be compared in absolute terms. However, because the BAU option adds no new benefits, these can be referenced to zero. Doing so allows a more straightforward

comparison of the options, one that avoids a complicated and error-prone calculation of the BAU option's individual benefits.

For optimism bias percentages, HM Treasury (2013) guidance figures are used whilst appreciating that these may be outdated. For the NHS model, an upper-bound of 24% is applied to the CapEx, reflecting the increased cost overrun risk in the public sector. For the JV model, 10% is applied to the CapEx, which is conservatively high. This covers an increasing scope should the NHS as co-partner have an unexpected change in needs. For simplicity, no percentage is applied to either OpEx. The recommended discount rate of 3.5% is used to calculate present values in the discounted cash flow calculation which can be found in Appendix 1.

Imaging provides an economic benefit and that can be translated into a monetary value that represents the benefit of a single imaging activity (e.g. CT or ultrasound scan). There are usually two ways to calculate such a figure and these are often combined and weighted. These are: the cost saved to the healthcare system; and the gain in productivity through enhanced economic activity (HM Treasury, 2022). For the PVB calculation, a conservative blended figure is used which focusses on the cost-saving component. The following paragraph explains why a blended benefit of £125 per imaging activity is used here.

Early detection of the most common cancers can save the NHS approximately £12,500 (Butnari et al., 2025). Direct access CT scans by GPs have found cancer detected in approximately 9% of cases (Friedemann Smith et al., 2025). Even low-dose CT screening in asymptomatic people has shown cancer yields close to 1%

(Bhamani et al., 2025). Ultrasonography, a common imaging modality, has also demonstrated a 2-3% cancer yield (Ingeman, Ormstrup and Vedsted, 2015). A £125 benefit is realised if just 1% of all imaging activity detects early cancer, saving £12,500 in each case. By using £125 there can be an assumption that 99% of imaging activity produces zero economic benefits. In reality, this is not the case as other conditions (e.g. pneumonia) are identified and diagnosis aids return to work — both examples of economics benefits. Intentionally sidelining these benefits tests the value for money case under pessimistic conditions which is a powerful demonstration of the 'margin of safety' principle (Klarman, 1991). Such an approach avoids over-inflating the NPSV and manages risk.

Under the assumption a private sector partner would want to drive down production costs and enhance procurement efficiency, a 10% discount is applied to the JV model's CapEx. A 20% performance capacity above the NHS model is assigned to the JV model, assuming here that a private provider would be incentivised to maximise operations in order to maximise profits. Savings-as-benefits are listed because the NHS has relied heavily on private providers to meet imaging targets, spending £325 million for this in 2024 alone (RCR, 2025). With extra capacity, this work and saving would migrate back to the NHS. Double-counting of displaced private provider work is mitigated with a defined repatriation allowance which is kept level for both models using a realistic figure. It is appreciated that repatriated imaging cannot be both a saving and new revenue source simultaneously. Calculations that support the additional imaging activity numbers for Options 2 and 3 can be found in Appendix 2.

Table 3.3: Key assumptions and inputs; calculated PVB, PVC; NPSV and BCR.

Category	Option 1 BAU	Option 2 NHS Model	Option 3 JV Model
General			
Timeframe of Analysis	10 years	10 years	10 years
Setup Time in Years	0	3	1
Operations Start	Ongoing	Start of 4th Year	Start of 2nd Year
Active Years (AY)	10	7	9
Discount Rate	3.5%	3.5%	3.5%
Optimism Bias	0%	24%	10%
OpEx | Annual	4.0	4.0	4.8
Imaging: Extra Activity / Yr	0	75,000	90,000
Imaging: Repatriated / Yr	0	-10,000	-10,000
Imaging: Net New / Yr	0	65,000	80,000
Imaging: Benefit Per Activity	£125	£125	£125
Imaging: Extra | £ million	0.0	8.1	10.0
Savings: Annual | £ million	0.0	2.0	2.0
PV of Benefits | £ million			
Sum of AY: Imaging Extra	0.0	49.5	76.1
Sum of AY: Savings	0.0	12.3	15.2
TOTAL 10 Year PVB	**0.0**	**61.8**	**91.3**
PV of Costs | £ million			
CapEx	0.0	20.0	18.0
Optimism Bias Risk Premium	0.0	4.8	1.8
Residual Infrastructure Value	0.0	-16.0	-14.4
Sum of AY: OpEx	33.3	24.5	36.5
TOTAL 10 Year PVC	**33.3**	**33.3**	**41.9**
NPSV | £ million	**-33.3**	**28.5**	**49.4**
Benefit-Cost Ratio	**0.0**	**1.9**	**2.2**

3.3.3 | **NPSV Analysis**

The NPSV figures shown in Table 3.3 demonstrate that the JV model delivers the greatest economic value. Ranking second is the NHS option which still produces a sizeable positive value to society. The BAU option shows a net economic loss to society, meaning that a "do nothing" approach is economically unviable — society is guaranteed to lose this way. In contrast, society would gain from either the NHS or JV models, but it would experience substantially greater gain from the latter, or £20.9 million more in cash terms. The costs associated with implementing the NHS or JV models is heavily outweighed by the benefits yielded, supported by the strong Benefit-Cost Ratios for both. In real application, the benefits are likely be higher given the prudent assumptions made. Satisfactorily, very positive NPSVs have been demonstrated with parameters that are conservative, not ambitious.

Key drivers of the additional value conferred by the JV model are the earlier start of operations and the higher output of imaging activity which is a function of its greater efficiency. This superior efficiency is a critical driver of JV model's higher NPSV. If costs and active years are controlled for in both models, the JV model still delivers greater value. The earlier start date of the JV model means there are a whole two years of benefits being delivered when the NHS model is delivering none. Where the NHS model leads is its more cost-effective OpEx. However, there is a flaw in looking at costs in this isolated way. Instead, BCRs should be compared because this ratio captures the benefits gained from the cost outlaid. For the JV model, a BCR of 2.2 proves that the higher cost is justified by the substantially higher benefit this achieves for society. The NHS model with its lower BCR cannot boast this. It is evident that the JV model represents the best value for

money. It is the most impactful, efficient and value-generating option for society. If this option were to operate at a larger scale, these qualities and the differences between options would be amplified further.

3.3.4 | **Risk and Sensitivity Analysis**

Wherever appropriate, conservative assumptions were made as part of a risk mitigation approach. As such, there is a 'margin of safety' built into the output figures and subsequent NPSV. Thus, the risk of optimistically inflating value has been considerably reduced.

The 24% optimism bias factor applied to the NHS model's CapEx reflects the elevated cost overrun risk of the project under public sector management. By using the upper-bound figure from HM Treasury guidance, a higher probability of this happening has been captured. In the JV model, the private sector would own all or most of the CapEx-related risk and a private partner would have strong reasons to manage cost overrun risk reducing the probability of inefficient spending. However, the economic case examines the balance of benefits and costs to the whole of society, not of individual partners. For this reason, a cost overrun risk by a private partner must still be considered because it reflects the risk of additional consumption which is an economic cost. For the JV model, using 10% effectively captures this risk.

Table 3.4 provides the output figures following stress testing of three scenarios. Analysis of the sensitivity of the options is summarised in following points:

- **Cost Spike Impact:** If the capital costs for the JV model were to increase by 10% for both the CapEx and activity period OpEx, its revised NPSV and BCR still eclipse the NHS model's base scenario. A similar 10% capital cost increase applied to the NHS model drives its BCR down to 1.6. The JV model's higher base BCR means it can weather this cost overrun and still provide better value to society.
- **Start Date Impact:** If the JV model experienced delays of two years and operations were to start at the same time as the NHS model with costs remaining static (based on the contractual risk transfer this should be so), the JV model would deliver an NPSV that is comparable to the base NHS model. Such a significant delay would still deliver economic value (NPSV) and value for money (BCR) for society, however, both are diminished with this delayed start.

Table 3.4: Scenario stress tested outputs.

Scenario	Option 2 NHS Model NPSV £m	Option 2 NHS Model BCR	Option 3 JV Model NPSV £m	Option 3 JV Model BCR
Base Scenario	28.5	1.9	49.4	2.2
+10%: JV CapEx & Opex	28.5	1.9	45.6	2.0
+10%: NHS CapEx & OpEx	24.1	1.6	49.4	2.2
2 year delay: JV Model	28.5	1.9	24.0	1.5

3.3.5 | Preferred Option

Following the SCBA, risk and sensitivity analyses, the Joint Venture model (Option 3) is recognised as the preferred option to investigate further. This option demonstrates the highest NPSV, highest BCR, and credible robustness under stress testing. This option also aligns with the strategic needs set out in Chapter 2.

Chapter 4 | **The Commercial Case**

4.1 | **Corporate Structure**

The identification of the JV model as the preferred option validates the hypothesis in Chapter 1 that stated a JV model would be best placed to tackle the imaging capacity deficit. The economic case analysis in the previous chapter proves that Nexus has reason to be explored further as a commercial reality. This chapter aims to do this and frames Nexus within a realistic and viable corporate structure.

In order to deliver Nexus, the appropriate corporate structure is one that splits operating activities from infrastructure into distinct entities. This delivery mechanism requires the private sector partner (PSP) to have two separate roles in the following integrated business model:

- The PSP will be a 50% partner in the operating entity known as "NexusOp LLP", a Limited Liability Partnership (LLP) that is responsible for operations.
- The other 50% partner is a Special Purpose Vehicle (SPV) formed of the three acute NHS Trusts in the Coventry and Warwickshire ICS.
- The operating entity formed by the PSP and SPV is referred to as "NexusOp". All operating profits are split 50:50 between the PSP and SPV.
- The SPV has an equity split based on the proportion of ICS population it serves, distributing profits to Trusts accordingly. Voting rights are kept equal.
- The PSP separately owns a 100% stake in a subsidiary known as "NexusProp" which owns and manages all property and infrastructure, including imaging equipment. NexusOp commits contractually for 15 years to NexusProp.

The SPV equity split allows Trusts to share in profits from NexusOp, something which could not happen under a PFI structure as discussed in Chapter 2. The shareholder's agreement would preserve equal voting rights so that smaller Trusts do not experience a lesser say in operational activities that impact them. This proportional split of equity allows all Trusts to profit in a proportion similar to their existing structures and prevents smaller Trusts gaining a disproportionate profit share. Smaller Trusts maintain an equal voice through an equal voting split in the shareholder's agreement.

The separation of the PSP's property subsidiary insulates the NHS from the risks of construction, ownership and equipment maintenance. This structure is also compliant with IFRS 16 accounting rules (HMFA, 2023). This split of CapEx is crucial because it allows the NHS to use its Revenue Department Expenditure Limit (RDEL) for imaging activity and avoids the punitive constraints of the CDEL (Anandaciva, 2025). This model extends the reach of the NHS SEP model (Naylor, 2017). Key differences are that NHS land use is not central to execution and NexusOp generates a distributable income based on activity, not just rental profit.

Governance of NexusOp will sit under a JV Board bringing together clinical oversight from the NHS Trusts with commercial acumen from the PSP. The 50:50 split gives the locally represented NHS (via the SPV) an equal voice on operational decisions to the PSP. To avoid commercial conflicts of interest, NexusOp as an effective tenant will not have a Board seat in NexusProp but it will retain the right to communications and hold observer status for transparency.

To ensure a timely and validated procurement process, the NHS SBS Framework will be used, with a competitive and accelerated tendering process.

4.2 | **Payment Mechanism**

Standard NHS payment mechanisms rely on specific tariff rates set out in the NHS Payment Scheme (NHS England, 2023a). For Nexus, imaging will be paid directly to Trusts for regulatory and legal simplicity, keeping to current practice. A Unitary Charge (UC) for each imaging activity undertaken by Nexus will then transferred to NexusOp. The difference between the tariff rate and UC is retained by Trusts. This serves a vital function: it pays for existing NHS Trust staff (e.g. radiologists), Trust administration and booking — services that support NexusOp. This also preserves NHS payroll, contracts and pensions. NexusOp receives its revenue from the UC with less operational costs to handle itself. From the UC, NexusOp pays NexusProp a fixed service fee to handle all infrastructure costs. Table 5.2 in Chapter 5 shows this flow in more detail.

Most NHS PPP models have seen the NHS capital exiting entirely (e.g. PFI) or returning via a rental yield (e.g. SEP). In contrast, Nexus ensures shared profits that are a function of imaging activity, which is itself enhanced by efficiency. Through NexusOp, a circular healthcare economy is created as dividends from profitable imaging activity allow Trusts to invest in better healthcare services. Similarly, the PSP is able to enhance its network of CDCs as it generates profits, thus growing its own value.

4.3 | **Risk**

For Nexus to succeed, commercial risk must be distributed in such a way that value for money is safeguarded. If the PSP were to bear high risk, the heavy premium to offset this would likely destroy any value for money case. For Nexus, risk can be categorised broadly as infrastructure-related risk and operational risk. Table 4.1 shows this breakdown.

Table 4.1: Risk distribution and impact weighting.

Risk Domain	Risk Owner(s)	Impact Weighting
Construction	PSP	100%
Building Maintenance	PSP	100%
Imaging Equipment	PSP	100%
Low Demand	PSP & NHS Trust	80% PSP : 20% NHS
Workforce Shortages	PSP & NHS Trust	50% PSP : 50% NHS

The infrastructure risk carried by the PSP is offset by key contractual obligations: NHS Trusts must direct all workflow to NexusOp and not to any other provider; a minimum volume guarantee covering fixed costs will be secured for the PSP. This guaranteed and protected revenue stream provided by the local NHS significantly diminishes risks to the PSP. For 15 years, it can operate without any competitive threats or any customer acquisition costs. This contract length reflects the need for commercial risk management that the 10 year timeframe tested in the economic case would underserve.

Operations are where risks are shared. It is in the interest of local NHS Trusts to ensure that key labour is available, such as radiologists. Given their 50% partner

status and the reimbursement mechanism, NHS Trusts are incentivised to ensure smooth and cost-effective operations. If they can capture work efficiently, this will enhance their reimbursement income and profits through NexusOp, whilst mitigating costly tele-radiology outsourcing.

Chapter 5 | **The Financial Case**

5.1 | **Capital Requirements**

This chapter tests and demonstrates the affordability of Nexus. Benchmark industry data shows that Nexus would require an initial capital outlay of £18 million to implement with a breakdown shown in Table 4.1. *Healthcare Premises Costs Guides* published by the NHS (2021) provides a specific construction cost for diagnostic imaging infrastructure of £2,320/m². This figure is used for modular construction cost estimate and has been adjusted to reflect inflation. Imaging equipment costs formulated by DHSC and published by HM Treasury (2024b) have been used in estimating equipment costs which is a significant cost driver for NexusProp. The PSP will be able to fund NexusProp through either debt or equity. Crucially, the NHS will bear no implementation cost or balance sheet exposure from NexusProp, and have no CDEL bureaucracy to contend with.

Table 5.1: Estimated costs for Nexus implementation.

Cost Element	Description	Estimated Cost | £m
Construction	• 1 Large Modular Unit (Hub) | 1,000m² • 2 Single Modular Units | 440m² each	4.5
Imaging Equipment	• 3 MRI Scanners | £1.0m each • 4 CT Scanners | £850k each • 3 Ultrasound Rooms | Prov. est. £100k each • 1 X-ray Room | Provisional est. £250k each	7.0
Digital Infrastructure	Full IT setup and AI integration.	2.0
Professional Fees	Planning, Project Management & Design.	1.5
Other	Represents VAT and other costs.	3.0
	Total Capital Outlay | £m	**18.0**

5.2 | **Affordability**

To assess affordability, national tariff data from the Payment Scheme published by the NHS (2023a) has been used to calculate and demonstrate affordability at the unitary and aggregate levels. Table 5.2 shows unitary modelling using a typical MRI scan tariff of £130. Table 5.3 uses unitary tariffs to calculate the annual income. The unit economics for MRI scans are applied to all imaging activities.

Table 5.2: Statement breakdown of MRI scan tariff unitary flow.

Statement Line Item	£	Description
Gross Income to Trust: TARIFF	**130**	NHS tariff payment (ICB to Trust).
Less: Trust Retained	(50)	Pays for Trust staff (plus admin, IT)
NexusOp Revenue: UC	**80**	The 'revenue' NexusOp makes.
- NexusProp Lease Fee	(30)	Fee covers all infrastructure costs.
- Other Staffing Costs	(20)	For other staff and outsourcing.
NexusOp Operating Surplus	**30**	Income available to LLP partners.
Income @ 50% to SPV	**15**	Share of surplus to NHS Trusts.
Income @ 50% to NexusOp	**15**	Share of surplus to PSP.

Table 5.3: Weighted-average volume of extra imaging activity of 90,000. The proportions applying to the MRI unit economics are applied to all imaging activities.

Imaging Activity	Tariff £	UC £	Percentage Extra Volume	Volume By Activity	NexusOp Revenue from UC | £
MRI Scan	130	80	10%	9,000	720,000
CT Scan	78	48	25%	22,500	1,080,000
USS Scan	48	30	25%	22,500	675,000
X-Ray	26	16	40%	36,000	576,000
				NexusOp Revenue | £	**3,051,000**
				NexusOp Operating Surplus | £	**1,144,125**
				PSP Share of Surplus | £	**572,063**
				NHS Trusts Share of Surplus | £	**572,063**
				NHS Trusts Retained | £	**1,869,967**

The figures in Table 5.3 are based only on the additional imaging activity that Nexus provides (90,000). With greater efficiency, Nexus would be able to capture more imaging activity within the ICS and thus generate greater revenue. The percentages that each imaging activity represents as a proportion of the total volume is derived from NHS (2025a) imaging activity data and adjusted slightly to reflect Nexus' equipment balance. In this model, NHS Trusts are able to retain 38% of all tariff income. Approximately 50% of top line tariff income goes to staffing costs which is in line with healthcare sector norms (The King's Fund, 2025).

5.3 | **Sensitivity Analysis**

Whilst the above calculations demonstrate technical affordability based on unitary economics and total expected volume, true affordability must consider fixed cost hurdles, such as the lease costs to NexusProp. Only if a Break-Even Volume (BEV) is met or exceeded is true affordability demonstrated (Drury, 2020). Calculated using data in Table 5.3, the blended UC is £33.90. UC is used because this calculation is about the survival of Nexus.

Regular payments to NexusProp are non-negotiable and cover all infrastructure and building service costs. Assuming NexusProp is funded by a loan repayable over the 15 year contract with a 5% fixed interest fee, NexusOp would need to pay NexusProp £1,260,000 annually to cover this. Added to this would be a 2% of the original capital outlay as maintenance CapEx (£360,000) and an annual service fee (7%) for imaging equipment that equates to £500,000 — these percentages are in line with industry benchmarks. Therefore, fixed cost to the Nexus enterprise is

£2,120,000. For NexusOp, labour is a variable cost. Using these figures, the BEV can be calculated as follows:

$$\text{BEV} = \frac{£2{,}120{,}000}{£33.90} = 62{,}536$$

Overall, this financial modelling demonstrates clear affordability at micro and macro levels. It also demonstrates resilience as Nexus only faces serious threats if demand drops below 70% of expected volume. This is a robust 'margin of safety'. For the PSP, a minimum volume guarantee is a likely an essential pre-requisite to cover costs, obtain private financing and manage commercial risk. For the NHS, with its huge imaging backlogs and imaging demand only predicted to grow, providing a guaranteed volume represents very limited risk.

Chapter 6 | **The Management Case**

6.1 | **Governance**

NexusOp will have a Joint Venture Board consisting of the three acute NHS Trusts in Coventry and Warwickshire and the PSP. During the delivery phase, a Senior Responsible Officer (SRO) will maintain oversight of delivery and will remain accountable to the Board. NexusProp will have its own governance structure under the PSP, however, the NHS Trusts will have represented observer status (to avoid conflicts of interest) and be provided with regular communications.

Following delivery, a CEO will be nominated, replacing the SRO function, who will oversee NexusOp's business operations thereafter. A clinical director (consultant radiologist) will provide the mainstay of clinical oversight but they will also be supported by a 'link radiologist' in each Trust. The CEO will also be responsible for ensuring continued stakeholder engagement takes place, soliciting feedback for improvement at regular intervals.

6.2 | **Delivery, Risk and Resilience**

A pre-fabricated modular construction is anticipated to facilitate a timely delivery. Following signed agreements, the following schedule is expected:

- Months 1-3: Site searching, Planning, Design and Financing.
- Months 3-6: Construction commences.
- Months 6-9: Imaging equipment is installed and tested.
- Months 9-12: Operational rehearsals, final testing and training takes place.

A dedicated project management team will design the delivery process of the project. This team will main a risk register and report directly to the SRO. They will use a colour-coded system allowing for early identification of any risks to project delivery. Communication with the SRO will be regular allowing the Board to also be updated at regular intervals.

New technology will be used to facilitate activity booking and also to direct reporting workflow. A key pillar of NexusOp's integration will be this system. Given the risks of interoperability, a dedicated NHS IT manager will be given the task of ensuring there are no service issues during the testing phase. They will also be responsible for ensuring all staff have suitable training.

NHS and other NexusOps workforce will be given training during months 9-12 of delivery to allow familiarisation with operations. Training will introduce operational efficiency concepts adopted from Toyota (see Chapter 2).

6.3 | **Success and Continuity**

Success will be tracked by monitoring imaging activity. On a monthly basis, 7,500 imaging activities are expected, following the weighting shown in Table 5.3. A post-implementation review undertaken at 12 months will be overseen by the CEO. This review will be presented to NHS England given the strategic importance of Nexus. This review will be central to determining scalability of Nexus. To guarantee a continued service for patients, the local NHS will preserve the right to step-in if any element of Nexus fails or if key terms are broken. The NHS will also preserve first rights on any asset transfer when the contract expires.

Chapter 7 | **Conclusion and Reflections**

7.1 | **Conclusion**

Demand for imaging is showing robust growth and existing solutions, including a patchy CDC rollout nationally and locally, has failed to address this. National policy priorities such as improved community-based diagnostics and clear separation of workflows also remains unfulfilled. For years, six week wait times for imaging have remained elevated for a number of structural reasons. Nexus was hypothesised as a solution to these issues, introducing an integrated imaging module together with a business model innovation. The JV model addresses NHS capital constraints which have hitherto hampered infrastructure development.

Strategically, Nexus has the ability to fulfil recommendations set out in the *Richards Review*, NHS long term priorities and the local health needs of Coventry and Warwickshire ICS. Following a thorough evaluation of Nexus using the gold-standard Five Case Model, there is compelling evidence of its economic, commercial and financial viability. Throughout the evaluation, HM Treasury guidance was closely adhered to, adding rigour and credibility to these findings. The JV model tested for Coventry and Warwickshire would produce value for society, overcome NHS capital constraints using joint venture funding, and even provide financial returns to NHS Trusts whilst mitigating downside risk. This business case evaluation has demonstrated, at least on paper, that routes to address structural NHS challenges do exist.

It is important to give recognition to the limitations of this evaluation. At various stages, inputs or assumptions were required to generate outputs. The quality of these was given careful consideration but it remains possible that proxies used were not representative. Diligent research, bias mitigation and sensitivity analyses aimed to address these potential issues at every stage.

In summary, Nexus offers a compelling proposition. Joint venture models have been shown to work in healthcare systems in other countries and where a compelling business case exists, they should be considered in England. Without Nexus, imaging capacity is likely to remain constrained and waiting times will likely grow. With Nexus, the NHS has an asymmetric, low-risk high-reward, opportunity to fulfil its core mission and address a persistent backlog whilst contributing to long-term social value.

7.2 | **Personal Reflection**

Writing this business case has been a humbling experience. It has been both thoroughly enjoyable and challenging. When trying to construct a viable and innovative commercial solution, I was met with many hurdles due to the complicated legal and payment structures of different parties. In completing this work, I have become considerably more aware of the complexities of public-private partnerships, the commercial realities of them, and the risks parties must manage. In many ways, this business case has stitched together many different learnings from the Master's programme. The culmination of this Master's with this dissertation seems fitting given how much I have learnt during it. It has

challenged me to think deeply and broadly, and to consider the reader at every stage, knowing that their interest must be kept for 10,000 words.

Looking forward, I hope to use the learnings from this dissertation to explore new career goals. I hope to be able to discuss what I have learnt with colleagues, sharing insights and deepening understanding. Whilst I am confident that my appreciation of many areas has expanded, I am equally aware that learning is never-ending. This dissertation and the Master's programme is not an end in itself, rather it is part of a lifelong process of enrichment and growth.

7.3 | **Conflicts of Interest**

The author has no conflicts of interest to declare.

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Appendix 1
Discounted Cash Flow Worked Example

	Year	1	2	3	4	5	6	7	8	9	10	Sum of DV
Option 1	Benefit or Cost	4.40	4.40	4.40	4.40	4.40	4.40	4.40	4.40	4.40	4.40	
	Discounted Value	4.25	4.11	3.97	3.83	3.70	3.58	3.46	3.34	3.23	3.12	**36.59**
Option 2	Benefit or Cost	4.40	4.40	4.40	4.40	4.40	4.40	4.40				
	Discounted Value	4.25	4.11	3.97	3.83	3.70	3.58	3.46				**26.90**
Option 3	Benefit or Cost	4.40	4.40	4.40	4.40	4.40	4.40	4.40	4.40	4.40		
	Discounted Value	4.25	4.11	3.97	3.83	3.70	3.58	3.46	3.34	3.23		**33.47**

Appendix 2: Calculations to show how the JV can optimise scanning efficiency. These calculations show how equipment these models could reasonably own or use can produce the desired number of imaging activities.

Option 2: NHS						
	Units	**Op. Weeks**	**Days/Week**	**Hours/Day**	**Scans/Hour**	**Annual Total**
MRI	2	50	6	10	2.5	**15,000**
CT	2	50	6	10	3.5	**21,000**
Ultrasound	3	50	6	10	4.0	**36,000**
X-Ray	1	50	6	10	1.0	**3,000**
					TOTAL	**~75,000**
Option 3: JV | Toyota Lean Approach						
	Units	**Op. Weeks**	**Days/Week**	**Hours/Day**	**Scans/Hour**	**Annual Total**
MRI	2	52	7	12	3.0	**26,208**
CT	2	52	7	12	4.0	**34,944**
Ultrasound	3	52	7	12	4.5	**39,312**
X-Ray	1	52	7	12	1.0	**3,000**
					TOTAL	**~103,000**