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Sociedad Española de Radiología Médica

Proposal for the Continuous Renewal and Technological Updating in Radiology

Lifecycle Management Guide for Medical Imaging Technology

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Proposal for the Continuous Renewal and Technological Updating in Radiology

Lifecycle Management Guide for Medical Imaging Technology

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Supports

SEGECA RX
Seguridad, gestión y calidad en radiología

Develop

Fundación Signo

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Acronyms and Abbreviations

AIReF: Independent Authority for Fiscal Responsibility (Spain)

AMAT-I: High-Tech Framework Agreements Plan (Spain)

ASD / DSA: Digital Subtraction Angiography

COCIR: European Coordination Committee of the Radiological, Electromedical and Healthcare IT Industry

CONSIP: *Concessionaria Servizi Informativi Pubblicci* (Italy)

ESR: European Society of Radiology

FAO: Amancio Ortega Foundation

FENIN: Spanish Federation of Healthcare Technology

INGESA: National Institute for Healthcare Management (Spain)

MEDTECH: European medical technology industry association

MEPA: The Medical Equipment Proactive Alliance for Sustainable Healthcare

InvEAT Plan: Investment in High-Tech Equipment (Spain)

MINAP Plan: Primary Care Infrastructure Improvement Plan (Spain)

PERT: Program to Support Technological Renewal

MRI / RM: Magnetic Resonance Imaging

SaaS: Software as a Service

SERAM: Spanish Society of Medical Radiology

SNS: Spanish National Health System

CT / TC: Computed Tomography

I

Executive Summary

Medical imaging technology is one of the pillars of modern clinical practice, with a direct impact on quality of care, diagnostic turnaround times, territorial equity and the sustainability of the healthcare system. This document addresses this reality from a comprehensive perspective, updating the SERAM Technology Management Guide 2017 edition and providing a renewed vision after a decade marked by the expansion of diagnostic activity, the ageing of equipment and the deployment of major technology modernization programs such as the **InvEAT Plan** and **AMAT-I**.

This chapter summarizes the essential findings, reflections and recommendations of the Guide, providing a technical and strategic framework addressed to National Health System decision-makers and Regional Health Authorities, professionals, managers, engineering services, procurement departments and technology providers, both public and private.

I.1. Context: a decade of transformation and learning

Since the publication of the SERAM 2017 Guide, the Spanish healthcare ecosystem has undergone significant transformation:

- Sustained increase in diagnostic demand, reinforced by population ageing, oncological diseases and precision medicine.
- Prolonged investment crisis initiated after the 2008 economic recession and evident from 2014 onwards, leading to significant ageing of the installed base.
- Impact of the COVID-19 pandemic, which highlighted the need for flexibility and advanced diagnostic capacity.
- Exceptional availability of European fund transfers, which enabled large-scale and much-needed renewal of public equipment.

Despite these developments, comparative analysis shows that medical technology ageing has been a structural and recurrent problem, particularly in critical equipment such as CT, MRI and digital angiography. Historically, the Spanish National Health System has lacked stable planning instruments, homogeneous renewal criteria and an integrated digital ecosystem vision.

The SERAM 2026 Technology Management Guide is intended to provide an updated technical framework, a common standard and a sustainable roadmap for continuous modernization.

I.2. The role of the InvEAT Plan: achievements, limitations and lessons learned

The **InvEAT Plan (2021–2023)** has undoubtedly been the most ambitious publicly owned technology renewal effort undertaken in Spain. For the first time, a coordinated national strategy was deployed, with **earmarked funding**, **objective criteria** and a structured procurement model.

Key contributions

- Large-scale replacement of equipment older than 10–12 years within the public system.
- Notable improvement in technology density in critical modalities.
- **Definition of technology provisioning categories (bands)** according to the complexity of hospital service portfolios.
- Widespread use of Framework Agreements, recognized by professionals and managers as the most efficient model for complex purchases.
- Multidisciplinary participation and interregional coordination.
- Transparency and access to basic data by the Autonomous Communities.

Observed limitations

- Overly tight implementation schedules, generating pressure on planning and execution of works and installations.
- Lack of a **prior National Installed Base inventory**, complicating data aggregation.
- Did not address renewal of satellite systems (Contrast injectors, monitoring, MRI-compatible anesthesia machines) nor the digital ecosystem (PACS, post-processing)
- The time lag between initial data collection and execution created situations where equipment 8–10 years old at installation, not included in the plan, became obsolete by the end of implementation.

Strategic conclusion

InvEAT enabled a partial reset of the public installed base, but its impact must be understood as **a starting point rather than an end state**. Technological modernization must continue through a **sustained investment model** rather than intermittent shock programs.

I.3. The structural problem: an erratic procurement model

Historical analysis reveals a recurring investment pattern:

- **Years of low investment**, with accelerated ageing.
- **Extraordinary peaks** when external funds arrive.
- A new ageing phase with a risk of a ***'cliff effect'*** (simultaneous obsolescence of multiple systems) at 8 – 10 years.

- Delayed investment impacts safety. In ionizing modalities (CT and Angiography), obsolescence has a direct impact on radiation dose to patients and professionals, underscoring the need for active renewal policies.

The analysis of the 2014–2025 period shows **highly erratic investment behavior**, with years of minimal renewal followed by peaks associated with extraordinary funds. This hinders regular amortization, increases maintenance burdens and delays adoption of clinical and digital innovation.

Hence the need to introduce annual control indicators: the **Sustainable Renewal Rate (TRS/SRR)** and the **Annual Equipment Procurement Indicator (NACE)**, to support quantification and monitoring.

I.4. Sustainable Renewal Rate (TRS/SRR) and the NACE Index as key tools for Investment management

One of the most relevant contributions of this Guide is the definition of the Sustainable Renewal Rate (TRS) and the NACE index to manage high-complexity technology.

The index estimates how many systems must be acquired annually to:

- Maintain the COCIR international standard:
  60% of equipment <5 years and less than 10% >10 years
- Ensure a continuous flow of innovation and clinical safety.
- Avoid future accumulation of obsolescence.
- Adapt to growing demand (between 3.8% and 5.5% annually depending on modality).
- Normalize investment, reducing emergency cycles.

Analyses show that the TRS required in Spain is approximately 11% of the installed base for CT, MRI and angiography. Applying this criterion to the public sector reveals a significant accumulated deficit across all three modalities based on published investments for 2024 and 2025.

TRS and NACE are proposed as objective instruments for annual planning, aligned with technical criteria and international experience.

I.5. Strategic lifecycle management: conclusions from expert forum

During 2024, SERAM coordinated three Expert Forums on imaging modalities, digital solutions and public procurement. Their conclusions underpin a modern, integrated vision of healthcare technology:

1. Five-year strategic planning

Technology should be understood as critical infrastructure. Multi-year planning reduces uncertainty, enables orderly amortization and improves coordination with works, infrastructure and digital systems.

2. National installed base

A single, updated registry managed by the Ministry of Health is essential to consolidate SNS technology assets, assess inequities and plan investments accurately.

3. Digital ecosystem

Equipment renewal cannot be decoupled from:

- PACS and storage systems.
- Post-processing and workstations.
- Networks, cybersecurity and interoperability.
- Satellite clinical technologies (injectors, MRI-compatible monitoring, etc.)

4. Efficient and professionalized public procurement

Experts highlight the need to:

- Framework Agreements with multiple awardees.
- Reduced weight of price.
- Expert judgement for non-quantifiable elements (image quality, ergonomics, workflows).
- Active contract monitoring.
- Market consultations.
- Professionalization of procurement roles.

5. Public-private alignment

The SNS should ensure that private providers meet the same quality and obsolescence standards required in the public system—at least for contracted services—to maintain diagnostic equity.

I.6.- International perspective

The Guide includes an annex analyzing international technology management models, including:

Canada:
(CMII) National inventory monitoring age, use and distribution.

Australia:
Reimbursement conditioned by equipment age ('capital sensitivity') and renewal incentivized by tariffs.

United Kingdom :
National diagnostic network strategy and integrated vision of equipment, PACS and infrastructure.

France:
Regulated 'forfait' model with decreasing payment as equipment ages, renewal often <7 years.

Italy:
Extensive use of Framework Agreements to standardize quality and technical criteria.

COCIR/MEPA:
Age profile and environmental sustainability standards.

I.7.- Main recommendations

1. Spain must transition towards **structural**, **annual investments**, not extraordinary one-offs.
2. **TRS/SSR** and the **NACE index** should be **implemented** as official metrics to guide renewal.
3. Technology management must include both equipment and the **digital ecosystem** and **associated clinical technologies**
4. Public procurement must align with professional, standardized and value-based models (**Framework Agreements**, expert judgement, evolving services).
5. Creating a **National Installed Base** inventory is a top strategic priority.
6. Collaboration between health authorities, professionals and suppliers is an asset to consolidate.
7. Contracted **private providers** must meet **homogeneous obsolescence and quality criteria** to ensure clinical equity.
8. Sustaining technological innovation is essential to improve outcomes, reduce dose, shorten diagnostic times and strengthen patient safety.

I.8.- Conclusion

This document provides a comprehensive, mature and technically robust overview of the status of medical imaging technology in Spain. It proposes concrete and feasible solutions to build a more modern, equitable and sustainable system, where **technology renewal** ceases to be a recurring problem and becomes a **planned health policy**.

With this Guide, SERAM consolidates its role as a technical reference to support strategic decisions that directly impact quality of care and patient safety.

II Introduction

The onset of the COVID-19 pandemic in 2020 increased awareness in Spain of the need for a healthcare system with greater capacity for adaptation, resilience and demand response, where technological innovation and obsolescence control are of great importance.

The EU recovery initiative, through the availability of European funds, enabled a strategic renewal of medical imaging equipment through the InvEAT project. Additional initiatives financed by the Autonomous Communities (CC.AA.) —including AMAT-I, PERT, MINAP and other targeted actions— reflect growing sensitivity among regional decision-makers regarding the importance of keeping technology up to date for healthcare delivery.

Imaging equipment used to perform procedures constitutes the technological assets of radiology services. Radiology scientific societies, including SERAM, understand the relevance of the condition of these assets for achieving specialty goals and have therefore developed documents and guides. Annex IV summarizes the main conclusions of the 2017 ‘SERAM Obsolescence Guide’ (Ref. 1), as it was commonly referred to in the sector.

That Guide inspired the in-depth analysis conducted by the Independent Authority for Fiscal Responsibility (AIReF) (Ref. 2), which confirmed the need to address technological updating and to increase equipment density to allow more equitable access across Autonomous Communities.

In addition, the recommendations of the SERAM 2017 Guide were used as a key documentary basis for defining the criteria and foundations of the InvEAT Plan (Ref. 3).

Nine years later, SERAM considers it necessary to update the Radiology Technology Management Guide, which:

- ✔ Updates the status of obsolescence after recent investment programs, analyzing the trend over the last 10 years.
- ✔ Reviews international lifecycle management processes as comparative references.
- ✔ Proposes monitoring initiatives and criteria to help maintain the technological structure and manage associated information systems.

SERAM would like to thank **Fundación SIGNO** for its involvement in the documentary and conceptual development of this Guide, as well as **FENIN** for supporting its development and collaborating by providing access to market study data and trend analyses.

This Guide is intended not only to serve as an analytical document, but also as a reference for strategic decision-making in healthcare management.

Dr. José Carmelo Albillos
President of SERAM

III

InvEAT Plan

III.1 Analysis of impact on technological assets.

Approval of the InvEAT Plan (Ref. 3) was agreed by the Plenary of the Interterritorial Council of the SNS on 30 June 2021.

The Plan analyzes obsolescence using information from the 2020 National Hospital Catalogue (CNH20) (Ref. 4), complemented by information provided by the Autonomous Communities regarding their assets (installation date and activity).

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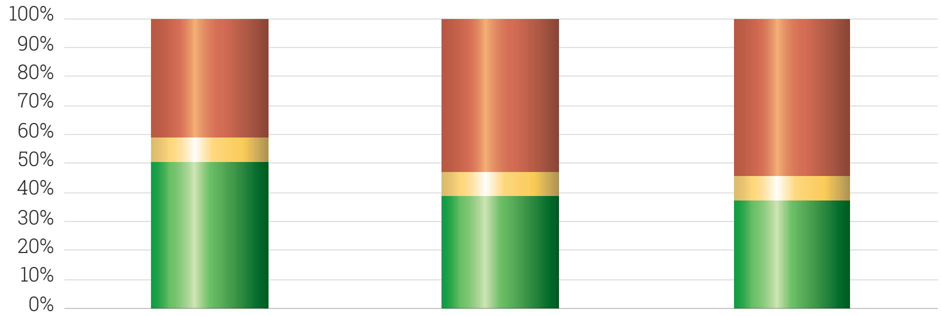
For the impact analysis on obsolescence indicators under COCIR standards, this Guide focuses exclusively on CT, MRI and Digital Subtraction Angiography (DSA/ASD), which are the high-capital modalities covered by the Plan and directly related to radiology services.

InvEAT published the number of systems available in the public healthcare system aggregated into age bands (<8 years; 8–9 years; 10–12 years; >12 years). These bands differ from those used by other documentary sources (COCIR, FENIN, AIReF), which segment into <5 years, 5–10 years and >10 years. To make information compatible with the scales defined in the SERAM 2017 Guide, this document aggregates the last two bands into a single >10-year band, which is the key obsolescence threshold.

Based on this segmentation, aging profile of public owned system in 2021 was the following:

Adapted SNS Age Profile in 2020



	CT	MR	DSA
> 10 years	258	163	99
> 8 and <10 years	51	25	15
< 8 years	320	120	68

< 8 years   < 8 and >10 years   > 10 years

Chart 1
Source: *Based on the InvEAT Plan document*

InvEAT addressed renewal and expansion of publicly owned equipment in the modalities analyzed accounting for:

Number of Systems Acquired Through InvEAT

	TAC	RM	ASD
Renovación	209	60	68
Ampliación	47	95	29
Total	**256**	**155**	**97**

Table 1:
Source: *Based on the InvEAT Plan document*

The Plan's objectives included replacing all equipment older than 12 years and increasing equipment density by 15% through expansion units. Because data were collected in 2021 and the Plan was executed through the end of 2023, some systems in the 10–11-year band had surpassed 12 years by completion, illustrating the dynamic nature of obsolescence and reinforcing the need for an annualized, planned monitoring index derived from the **Sustainable Renewal Rate (SRR)**. This index is derived from the SSR and represents the **annual investment** needed to maintain the obsolescence profile according to the guidelines outlined in the 2017 SERAM Guide. Based on this rate, an index will be calculated that represents the number of units that will need to be replaced annually to maintain the recommended technological age profile.

The calculation of this index is discussed later

What has been the impact of the InvEAT Plan on technological assets across the healthcare system?

Annex I details calculations for available CT, MRI and interventional radiology (ASD/DSA) systems based on public data sources. The ratio of publicly owned equipment renewed relative to the total SNS owned assets reaches approximately 40%, indicating significant impact within public assets. However, when extending the calculation to the total installed base in Spain (public and private), the impact is more modest, especially for MRI and CT (MRI ≈ 13% and CT ≈ 20%), where private sector participation is substantial.

Considering that the Plan was deployed over three years, annualized average investment levels are closer to what should be the Sustainable Renewal Rate described in Chapter V, which should become the standard investment norm. Therefore, while InvEAT provided resources for a necessary renewal of public medical imaging technology, it should be understood as a **catalyst to normalize technology inventories**, which require continued strategic approaches and sufficient funding **to maintain innovation profiles and international standards**.

Applying the available information on inventory and investment calculations, documented in Annexes I and II, the obsolescence profile of radiological imaging technology as of January 2024 is as follows:

Computed Tomography (CT)

Age Profile CT in Spain (2024)

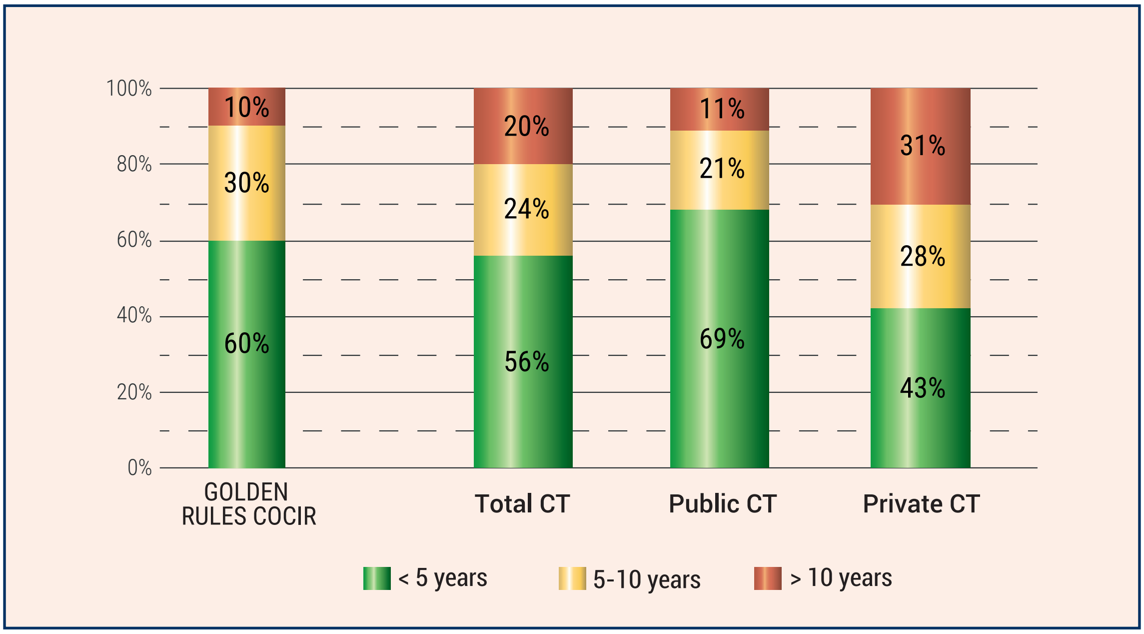


Chart 2
Source: *InvEAT Plan document and other sources of Annex 1*

Public CT assets align closely with COCIR recommendations, with 11% of systems older than 10 years. In contrast, private assets show significantly higher age, with 31% older than 10 years. This is highly relevant because modern CT advances provide significant radiation dose reductions, directly affecting patient protection from ionizing radiation exposure.

CT density in Spain is 26.2 units per million inhabitants: 13.4 public and 12.3 private per million.

Magnetic Resonance Imaging (MRI)

Age Profile MRI in Spain (2024)

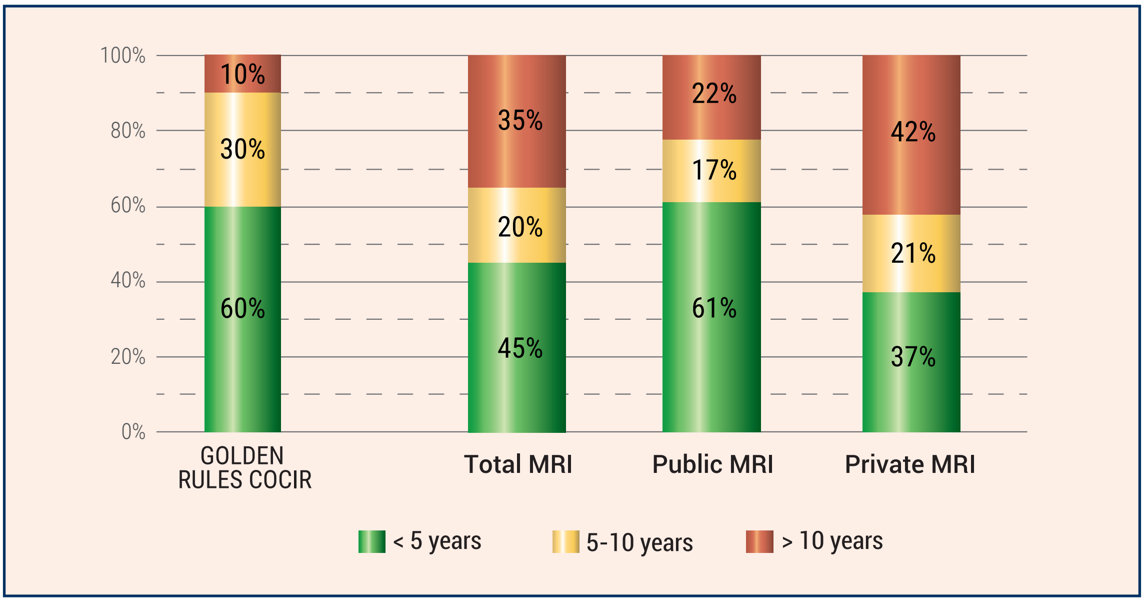


Chart 3
Source: *InvEAT Plan document and other sources of Annex 1*

MRI has high private ownership dependence (66%), with 797 privately owned systems above 1 Tesla versus 403 publicly owned systems. This is one reason the aggregated impact of InvEAT on MRI obsolescence has been smaller. Private MRI includes a high proportion of old systems (42%), clearly outside recommended profiles.

The public system does not show an outstanding profile despite the Plan, with double the proportion of >10-year systems relative to recommendations. One reason is that systems updated via hardware/software renewal while retaining the magnet were considered outside the InvEAT renewal scope. Combined with the three-year lag from data collection to completion, this explains why 22% of public MRI systems were still older than 10 years as of 1 January 2024.

MRI density in Spain is 24.6 units per million inhabitants: 8.3 public and 16.4 private per million.

.

Digital Subtraction Angiography (DSA/ASD):

Age Profile Angiography in Spain (2024)

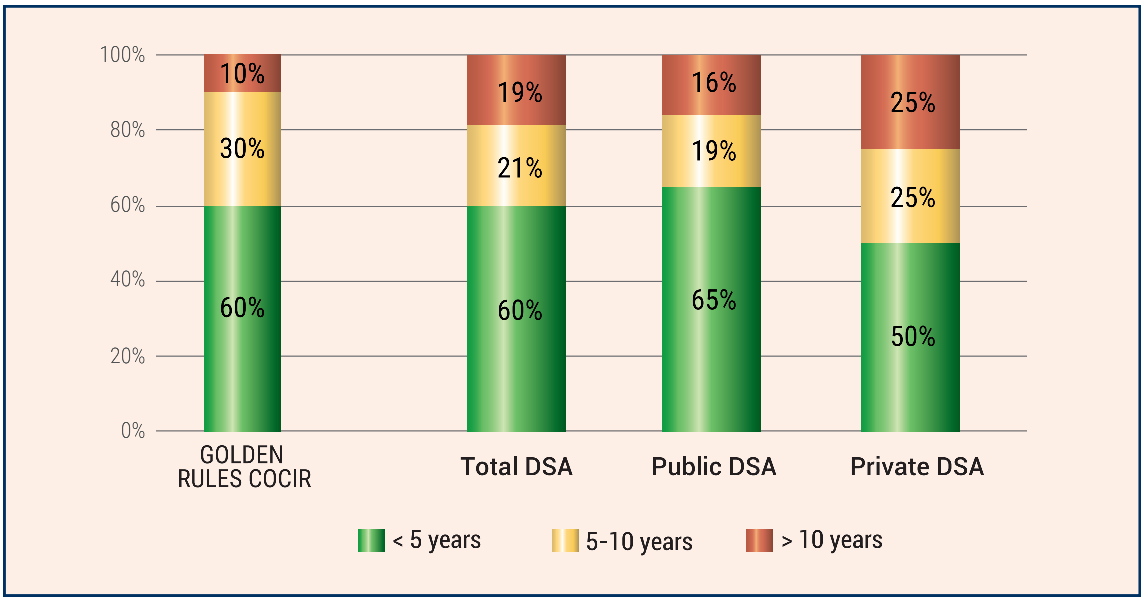


Chart 4
Source: *InvEAT Plan document and other sources of Annex 1*

Angiography suites show the opposite ownership profile to MRI, with greater public dependence due to their role in urgent, high-complexity therapeutic pathways (stroke, myocardial infarction, hemorrhage, etc.). Private hospitals account for 34% of suites but have higher obsolescence (25% older than 10 years). As with CT, delayed innovation has safety implications because newer systems provide improved radiation control for both patients and staff.

DSA density in Spain is 6.58 units per million inhabitants (vascular radiology and neuroradiology suites).

There is no published data specifically on the segmentation of image-guided interventional radiology (ASD) systems; therefore, estimates of equipment density may vary with other sources. The criterion used in this document is that ASD systems, specifically for vascular radiology and neuroradiology, represent 50% of the total image-guided interventional systems (radiology, cardiology and surgery) available on the market.

Private Sector:

The private sector plays a major role in diagnostic imaging. Based on the number of available systems, it likely accounts for more than 50% of CT and MRI diagnostic capacity. Consolidation among private providers and diagnostic centers concentrates over 60% of private CT and MRI systems within large groups, while local diagnostic companies and professional associations manage a little over 30% of privately owned systems.

The obsolescence profile of privately owned equipment in Spain, at the end of 2023, is as follows:

Age Profile Private Segment in Spain (2024)

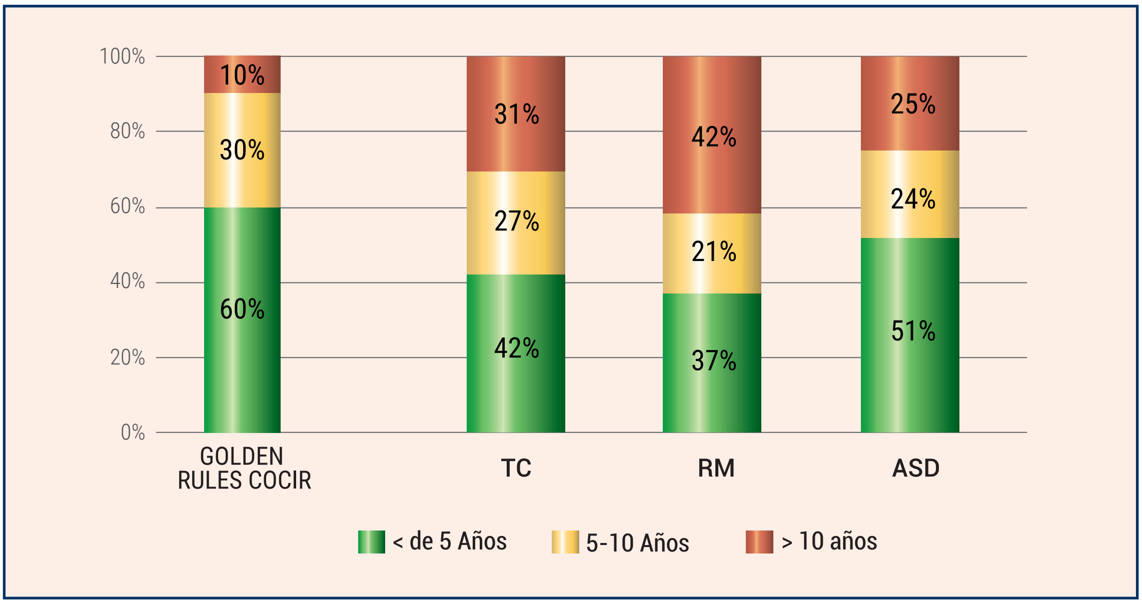


Chart 5
Source: *InvEAT Plan document and other sources of Annex 1*

The variability of private providers suggests that a substantial proportion of obsolete systems may be concentrated in low-cost diagnostic centers. Although there is a trend toward concentration among companies providing diagnostic imaging services, there are diagnostic centers, located in specific geographic areas, that enjoy a strong local presence given their proximity, services and predominance over private chains organizations more focused on areas with high population density. Even where activity volumes are lower, diagnostic centers are still expected to maintain image quality and radiation exposure standards aligned with current benchmarks.

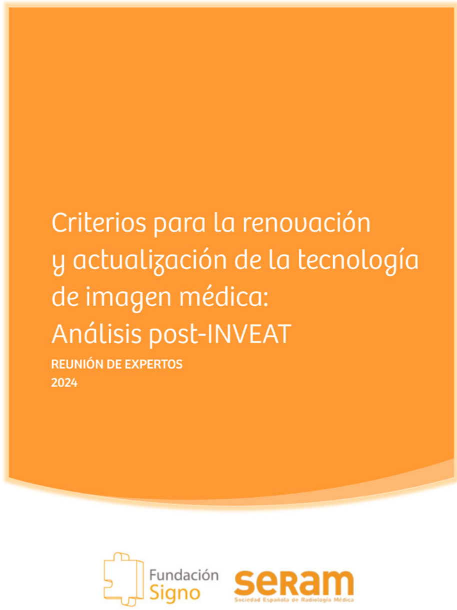
This should be considered when the public system contracts imaging services from private providers to ensure that contracted services use up-to-date equipment throughout the contract term.

III.2. Post-InvEAT reflections: retrospective view of the Plan

The impact of InvEAT on updating medical imaging assets justifies a reflective process regarding lessons learned, contributions and advantages, as well as identification of areas for improvement. Post-InvEAT reflections were addressed through an expert session held in March 2024 (Ref. 5). The detailed analysis is published on the SERAM and Fundación SIGNO websites.

Key positive aspects highlighted by experts:

- **Availability of protected and earmarked funding**, enabling focus on solving a structural problem and avoiding scope deviation.
- **Multidisciplinary working model** that brought together technologists, clinicians, scientific societies, the Ministry, Autonomous Communities, industry representatives and specialized procurement institutions (INGESA).
- **Clear, simple, auditable inclusion criteria** adapted to different care levels through defined technology bands.
- Procurement process based on **Framework Agreements** enabling agility and specificity, aligned with health canters needs and credit availability, and involving professionals in planning and functional decisions.



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- Joint, **collaborative**, **open** and **transparent** work between **Autonomous Communities** and **the Ministry** to define scope and the list of equipment to renew, including additional equipment to reduce access differences

Areas for improvement:

- Very tight execution timelines, creating additional pressure for healthcare organizations and suppliers.
- Management and funding of infrastructure works created tensions to ensure spaces were ready for installation.
- Lack of aggregated installed-base databases within the SNS, including activity, update status and maintenance indicators, limiting transparent needs/impact analysis by region.
- The Plan focused on imaging equipment renewal without fully considering the connected digital ecosystem (PACS). New systems often require greater computing, storage and communications capacity, and this creates incompatibilities in some centers.
- The Plan did not include renewal of satellite technologies linked to equipment operation (monitoring systems, contrast injectors, MRI-compatible anesthesia systems, etc.)
- Involving IT services in decision-making would have helped identify interoperability and functionality issues with digital imaging systems and post-processing workstations.

Renewal criteria:

Experts agreed that InvEAT's criteria—aging profile and intensity of use—were appropriate metrics. Additional criteria were suggested (maintenance services received, operating costs, upgrades, consumables cost, etc.). The consensus confirmed that the criteria published in the SERAM 2017 Guide remain a valid reference.

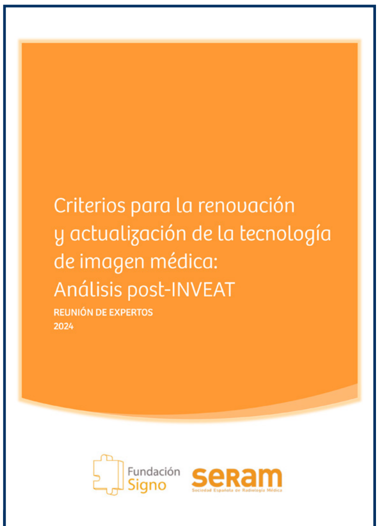
IV

Medical Imaging Technology Management and its Procurement Process

In addition to Post-InvEAT reflections, SERAM addressed different perspectives on radiology technology management through three Expert Forums (P.E.) held in 2024. These meetings have brought together renowned professionals, experts in their fields, who have allowed the development of three complementary perspectives:

- **P.E. 1** - Renewal criteria for medical imaging technology (March 2024) (Ref. 5)
- **P.E. 2** - Renewal criteria for digital solutions in radiology (January 2024) (Ref. 6)
- **P.E. 3** - Technology management and reflections on the procurement process September 2024; (Ref. 7)

The content of these sessions is transcribed in documents published by SERAM and Fundación SIGNO. This Guide includes a summary of the published recommendations from these complementary perspectives.



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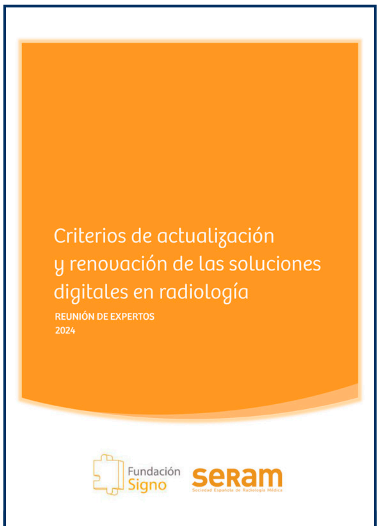

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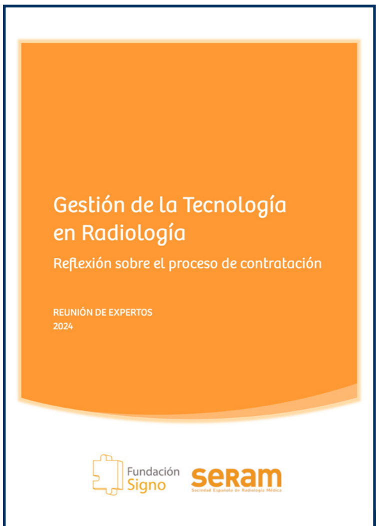

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IV.1. Criteria for renewal and updating of imaging modalities

Strategic planning: Investments in imaging technology should be planned through a 4–5-year plan. Strategic planning reduces uncertainty among stakeholders and facilitates acquisition, deployment and return on investment models.

Evolving procurement models: It is essential to ensure professional after-sales services and updates throughout the useful life to incorporate innovation as it emerges. Progressive incorporation of evolving maintenance models is recommended to enable new functionalities during the technology lifecycle.

Data-driven asset management: A core dataset of essential indicators is required, like those in reference countries such as Canada (Annex III). A single database should include acquisition price, operating cost aspects, activity performed, maintenance and upgrade processes and other parameters. This enables informed lifecycle management and monitoring of deviations, helping anticipate potential regional inequities. The database should be managed by the Ministry of Health and collected systematically, as is done for the National Hospital Catalogue.

Standards verification: A proactive standards compliance verification process can be useful for assets approaching obsolescence or beyond standard lifecycle, to ensure appropriate functioning and safety in care delivery.

IV.2. Criteria for renewal and updating of digital solutions:

Digital solutions are intrinsic to radiology care ecosystems. Today it is hard to imagine diagnostic imaging without a digital storage repository (PACS), image analysis and post-processing tools, the ability to share digital images across professionals/locations, and the use of computer-aided diagnosis and artificial intelligence (AI) algorithms.

Strategic planning: As in the previous section, medium-term planning of investments related to digital solutions is highly relevant. Today there is no structured planning for these investments.

Supplier agreements that include functional and technical updating and evolution: In supplier relationships, a **comprehensive service-level agreement** is more relevant than whether the asset is owned or contracted as a service (SaaS).

Evolving maintenance models enable shared management between supplier and centre over a long period. This avoids frequent data migrations and supports adaptation to evolution of base applications, software infrastructure and cybersecurity processes.

IV.3. Public procurement process and lifecycle managementa

Procurement is a multidisciplinary process involving technologists, healthcare professionals, legal and financial services, coordinated by procurement experts.

Areas for structural improvement highlighted by experts:

Harmonization of evaluation criteria: high variability exists across regions in documentation, administrative requirements, weighting of criteria and other aspects.

Professionalized purchasing processes with greater documentary homogeneity and harmonized formal requirements are recommended across Spain.

Professionalization: procurement follows sequential steps required by law. Training and professionalization are needed to increase knowledge among participating agents and improve agility and efficiency.

Contract monitoring: opportunities exist to improve follow-up to ensure compliance, enabling full optimization and deployment of contracted ensure full optimization and deployment of contracted capabilities.

Process digitalization: procurement remains highly manual and could benefit from new technologies to share experiences, knowledge and use cases among regions.

Collaboration: increased collaboration between suppliers and procurement departments is needed to reduce information asymmetry and improve tender dossier development.

Public procurement of high-technology structural medical equipment

Procuring technology with high levels of innovation that requires continuous support for maintenance, user training and updates presents significant challenges for applying standard acquisition methods under Spanish public procurement law (Law 9/2017, Public Sector Contracts). Key requirements include:

Planning: Procurement services and management must be integral to planning from the outset. Investment planning for structural technology is strategic for healthcare organizations.

Data-driven decisions: planning renewal requires complete information on asset inventories and state, utilization (number of exams), consumables, production capacity and other variables to assess real performance.

Meaningful specifications: technical specifications must ensure unequivocal definition of the technology band required. Purely technical parameters do not always reflect differentiation in quality or clinical application; objective criteria should be complemented with expert-based value judgments.

Expert-judgment evaluation: subjective criteria are necessary when metrics cannot be fully objectified (e.g., image quality, usability). These should be documented by experts via demonstrations or use cases, especially for digital solutions.

Promote Framework Agreements: Framework Agreements with multiple suppliers are preferable to aggregated purchasing with a single awardee, leveraging economies of scale while allowing selection of the most appropriate supplier for each Centre's needs. InvEAT and AMAT-I have shown high satisfaction and efficiency.

Market consultations: market engagement helps understand the state of the art and supports consensus on specificati.

Minimize price as a criterion: for highly innovative technologies, price should have minimal weight; value should focus on after-sales services, updates, training, interoperability and cybersecurity throughout the 10+ year lifecycled.

Explore new models: the law allows multiple contracting models (purchase, lease, availability, pay-per-use, etc.), but administrative burden limits adoption. Decisions to purchase versus contract availability should be strategic, not opportunistic, based on short-term budget availability.

V

Sustainable Renewal Rate and the NACE Indicator

Chapter III described the impact of InvEAT on modernizing medical imaging technology assets. The obsolescence situation reached by Spain placed it among the worst in Europe for the proportion of equipment older than 10 years, which is why InvEAT is considered a shock plan without which it would have been very difficult to recover appropriate levels of technological updating.

Annex II shows the evolution of obsolescence since 2014, documenting annual investments in both public and private sectors. Public investment has been far below what is needed to maintain a standardized innovation profile, with specific peaks associated with external injections not included in normalized regional budgets: the 2018 Amancio Ortega Foundation donation, extraordinary CT acquisitions in 2020 due to force majeure, and the concentration of nearly 40% of publicly owned CT, MRI and ASD/DSA acquisitions in 2022 supported by InvEAT.

These extraordinary investments have updated public assets to recommended standards; however, public investment behavior in 2023, 2024 and 2025 suggests a return to a similar—if not worse—scenario within 8–10 years. This is compounded by the fact that 40% of equipment acquired under InvEAT will surpass 10 years of age in 2033, in addition to the accumulated investment deficit.

The Guide introduces an index to monitor compliance/deviation in renewal processes to maintain the obsolescence profile and align with international recommendations. This index, based on the Sustainable Renewal Rate, is the **Annual Equipment Procurement Indicator (NACE)**, representing the number of systems per modality that must be replaced annually to maintain the recommended age profile and adapt to expected demand growth. It is simple and easy to monitor and may be reviewed every five years to adapt to significant demand changes

Computed Tomography (CT):

Based on historical data (2014–2023), compounded growth in demand (new units) is equivalent to 5% annually. Total units acquired from 2014 to 2023 reached 1,081 systems, with highly variable annual acquisitions—especially in the public system. The pandemic response (2020) and InvEAT (2022) produced visible peaks.

Actual Acquisition Model vs. Planned Purchase Model in CT

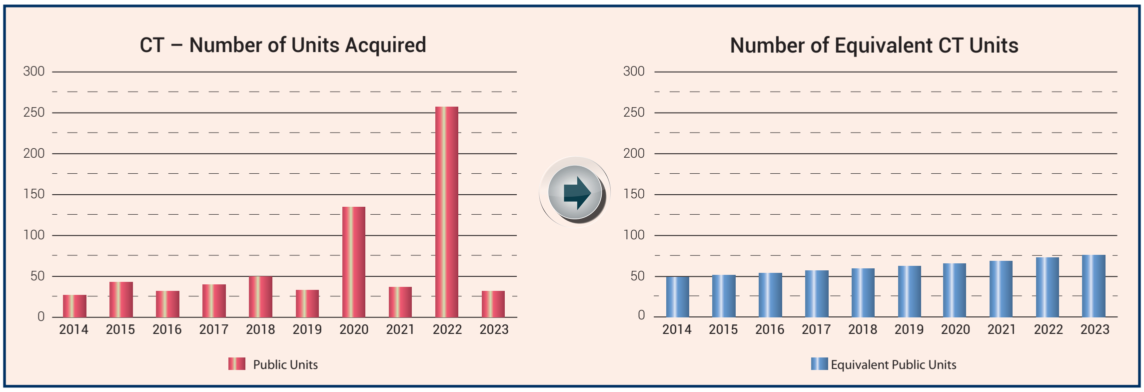

Chart 6
Source: *FENIN Market studies 2014-2023*

Such an erratic public investment model (left-hand graph) demonstrates a lack of planning and allows us to visualize the consequences for access to innovation, which will be fragmented and "in fits and starts", as well as the future impact on clustered obsolescence in 2033, when the more than 250 pieces of equipment installed in 2022 will be over 10 years old.

An acquisition and renewal model that follows the trend shown in the graph on the right, a planned model, seems more appropriate for managing investments and sequentially implementing innovation and technology. This is why it is desirable to have indicators that reflect the renewal rate, which would allow for maintaining up-to-date equipment and a continuous flow of renewal, measured in the number of units.

Calculations indicate a renewal rate of 11.2% of the annual installed base to ensure that in the future more than 50% of systems are less than five years old. A 5% annual demand growth is projected based on the last 10 years' trend. Under these assumptions, the Sustainable Renewal Rate yields the number of systems that must be renewed or expanded annually (NACE).

Focusing on the public sector and current ownership ratios, the NACE for CT should be:

CT-NACE Index: Nr of systems to be purchased by year 2024-2032 (Public Sector)

CT	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Units	80	84	88	92	97	102	107	112	118	124

Table 2
Source: *Annex I and II*

This Indicator should be monitored yearly to avoid significant deviations to prevent obsolescence. Furthermore, it should be reviewed every 5 years to ensure appropriate adjustments due to changes in demand.

Available data as of January 2026 show a high accumulated deficit: the public system acquired 18 systems in 2024 and 17 systems in 2025, corresponding to renewal rates of 2.52% and 2.28% respectively versus the 11.2% reference rate, resulting in an accumulated CT renewal deficit of 129 units in the public system by 2026.

Magnetic Resonance Imaging (MRI)

Historical analysis (2014–2023) shows compounded growth of 5.5% annually in the number of MRI units available in the market (all ownership). Total acquisitions reached 871 systems, with high variability and strong concentration in 2022 driven by InvEAT. Public MRI accounts for roughly 34% of installations in Spain, but the same 5.5% growth is used for prospective analysis.

Actual Acquisition Model vs. Planned Purchase Model in MRI

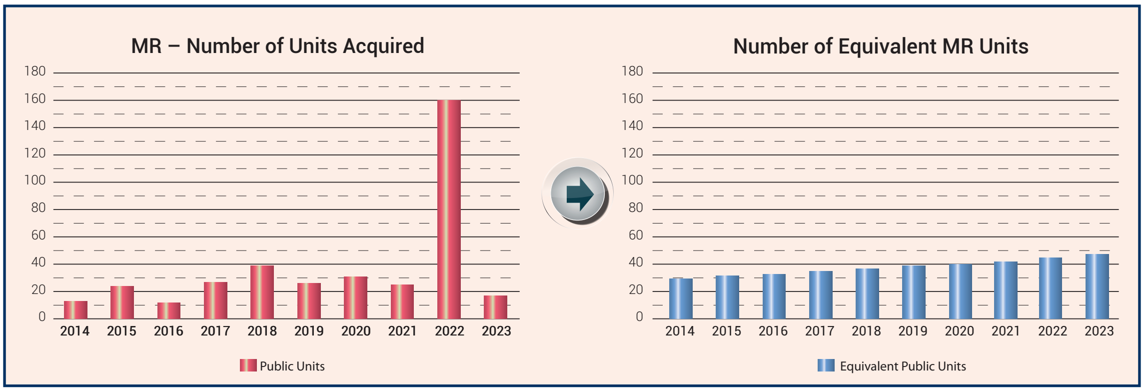

Chart 7
Source: *FENIN Market studies 2014-2023*

Such an erratic public investment model, as shown in the chart on the left, once again demonstrates a lack of planning, as well as the consequence of concentrating the acquisition of almost 40% of the entire active public fleet in a single year, especially given the future convergence of multiple pieces of equipment becoming obsolete simultaneously.

Calculations indicate a renewal rate of 11.2% of the annual installed base, as for CT, combined with 5.5% demand growth, yielding the NACE value for public MRI.

If we focus on the Public Sector, maintaining the obsolescence profile in accordance with published recommendations and the current asset ownership ratio, the Annual Number of Equipment Purchases (NACE Index) would be as follows for the RM:

MRI-NACE Index: Nr of Systems To Be Purchased By Year 2024-2032 (Public Sector)

MR	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Units	48	50	53	56	59	62	66	69	73	77

Table 3
Source: *Annex I and II*

As of January 2026, available data show an accumulated deficit: the public system acquired 10 MRI systems in 2024 and 22 in 2025. Compared with the NACE requirement (98 units across those two years), renewal rates were 2.33% and 4.95%, resulting in an accumulated deficit of 66 MRI units in the public system by 2026

Digital Angiography (ASD/DSA)

For angiography, historical analysis must start from aggregated interventional equipment market data, including systems for interventional radiology, hemodynamics and electrophysiology.

The information gathered from the analyses, carried out in Annex I, identifies the number of pieces of equipment corresponding to the concept of Angiography (ASD) for Interventional Radiology. Furthermore, the obsolescence profile figures published by FENIN, which aggregates comprehensive data on interventional systems (radiology plus cardiology), are maintained for this specific modality in Radiology (ASD) since we assume that the number of units is similar for both applications, Radiology and Cardiology. Thus, we start with the inventory of 320 units that we calculated for 2023

Actual Acquisition M odel vs. Planned Purchase Model in Angiography

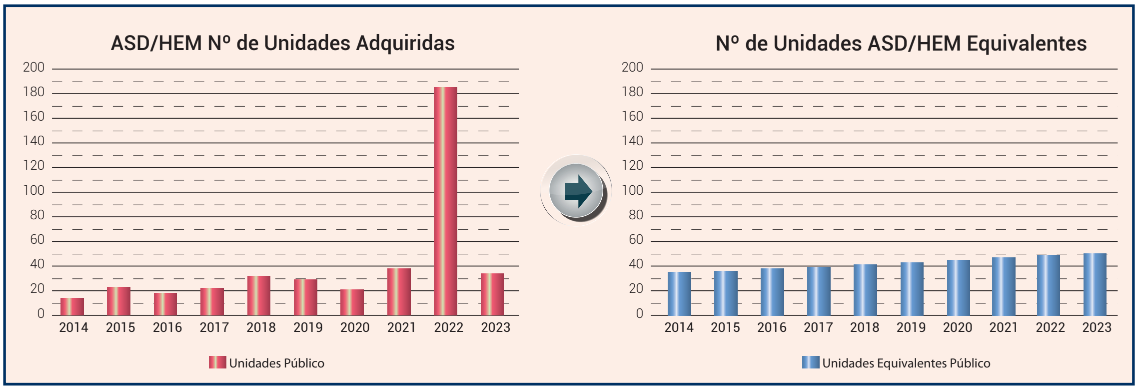

Chart 8
Source: *FENIN Market studies 2014-2023*

Acquisitions show high variability with a very strong concentration in 2022 (nearly 40% of decade purchases). Compounded annual growth is estimated at 3.8% from 2014 to 2023

Applying an 11.2% renewal rate and 3.8% demand growth yields the NACE for public ASD/DSA systems should be:

Angiography-NACE Index: Nr of Systems To Be Purchased By Year 2024-2032 (Public Sector)

DSA	2024	2025	2026	2027	2028	20298	2030	2031	2032	2033
Units	25	25	26	27	28	30	31	32	33	34

Table 4
Source: *Annex I and II*

As of January 2026, the public system acquired 10 systems in 2024 and 9 in 2025; compared with the NACE requirement (50 units across those two years), renewal rates were 4.48% and 4.03%, resulting in an accumulated renewal deficit of 31 DSA units in the public system by 2026.

VI Conclusions and Recommendations

Medical imaging technologies are an essential part of healthcare delivery because they provides high diagnostic accuracy, enable earlier disease detection, support faster and more effective therapeutic action, and allow more accurate follow-up.

SERAM, aware of the importance of maintaining appropriate technological resources to ensure the quality of care provided by professionals involved in diagnosis and image-guided minimally invasive therapies, has prepared this document to provide healthcare organizations with evidence on when and how to update or replace medical imaging technology in a planned manner, thereby guaranteeing quality of patient care.

The historical analysis of investment trends shows the risks of lacking documentary indicators that alert decision-makers about deviations—indicators that could avoid situations as severe as those recently experienced. The Guide confirms the value of applying international standardized criteria to promote renewal based on equipment age and intensity of use, ensuring access to innovation.

Recommendations:

- **Develop and maintain a complete registry of installed medical imaging equipment**, especially within the SNS. A single database should include relevant lifecycle indicators to enable monitoring of deviations and identification of potential regional inequities. The database should be managed by the Ministry of Health and could initially be integrated into the periodic Hospital Catalogue collection.
- **Strategic planning:** investments in imaging technology should be planned through a documented five-year plan within each Regional Health Authority. Planning reduces uncertainty and benefits acquisition, deployment and return on investment.
- **Establish objective criteria for equipment renewal.** InvEAT used age and intensity of use; these can be complemented by additional parameters. SERAM's recommendation, supported by international criteria, is to standardize useful life by utilization intensity such as:

Years of Useful Life vs The Intensity of Use*

	Intensive use	Standard use	Low intensity of use
Basic X-ray room	10 years	12 years	14 years
RC Fluoroscopy	8 years	10 years	12 years
Radiosurgical C-arm	8 years	10 years	12 years
Mammography system	8 years	9 years	10 years
Ultrasound System	7 years	8 years	9 years
CT scanner	8 years	10 years	12 years
MRI system	8 years	10 years	12 years
Angiography System	8 years	10 years	12 years

(*) The degree of utilization is defined in the Canadian Guide, but it can be adapted to the specific circumstances defined by Scientific Societies

Table 5
Source: *SERAM Guide 2017 (Ref 1)*

- **Implement and maintain agile, specific procurement models** to ensure continued access to innovation. Framework Agreements with multiple offers have proven efficient and have optimized resources through simplified administrative procedures.
- **Deploy incentives to reduce obsolescence** across the **entire healthcare system.** Given private sector participation in SNS-contracted services, contracts should require compliance with the obsolescence profile defined in this Guide to ensure an equivalent innovation profile for patients.
- **Implement evolving maintenance and services models.** Promote supplier agreements that include functional and technical updating and evolution; in imaging information systems, extend contractual relationships over longer periods to enable shared management, reduce data migrations and support cybersecurity)
- **Adopt an integrated view of the technology ecosystem.** Lifecycle management must cover modalities, satellite technologies, information/data systems and cybersecurity requirements to ensure compatibility, interoperability and safe operation.
- **Apply the Sustainable Renewal Rate (SRR) and publish the NACE Indicator** (adapted to different technologies) to monitor obsolescence and anticipate corrections before deviations become unmanageable for SNS resources.

ANNEXES

ANNEX I
Calculation of the Installed Base of Equipment in Spain

The InvEAT project promoted documentation and accounting of medical imaging technology resources across all Regional Health Services, published with project documentation. The data include number and age of public-sector systems for diagnosis and image-guided therapy in Spain, distributed by Autonomous Community. Although very useful, to create a complete installed base, including private owned assets, it is required to complement these data with additional references and publications from other sources.

Data Sources:

InvEAT Plan (Ref 3) uses the 2020 National Hospital Catalogue as the basis to identify public and private technology resources available in inpatient facilities. So, outpatient diagnostic centers without beds—common in private medicine—are not captured in CNH20 (Ref 4) while public outpatient centers are often organizationally linked to hospitals, so they are included in the catalogue.

InvEAT also provides complete region-level inventories for public systems dated in 2021, which are considered very close approximations to CNH20 figures.

The InvEAT Plan also defined the equipment that was to be renewed, as well as the number of additional pieces of equipment to be added with this plan, thus allowing for a calculation very close to what the inventory of publicly owned equipment would be in 2023, when the plan ended.

COCIR, *"Medical Imaging Age Profile and Density 2023"* publishes equipment density ratios per million inhabitants based on manufacturer installed-base information. This is a reliable source of information but it doesn´t segment equipment by ownership public and private sectors.

OECD also publishes indicators about countries' development where they establish figures for CT and MRI units' density.

Data Sources for Equipment Inventory

	CNH20 (1)	InvEAT (2)	COCIR (3)	OECD (4)
CT	829	676	1.236	1.037
MR	664	403	1.028	1.055
DSA	283	211	ND	ND

Table 6
Sources:

(1) El CNH 20 includes public and private medical equipment installed in hospitals (impatient facilities).

(2) The data on available public equipment (InvEAT Plan) are CT= 676, MRI= 403 and Angio= 211, including additional equipment acquired through the plan.

(3) COCIR, we used data on the density of publishing equipment in 2023. Rate per million inhabitants: CT= 25.6, MRI= 20.8, Angio= not specified due to the aggregation of Interventional Radiology and Cardiology systems

(4) OECD Statistics 2022-24: https://www.oecd.org/en/data/indicators/computedtomography-TC-scanners.html .
CT rate per million inhabitants (2022)= 21.39, MRI (2023)= 21.84, Angio= not specified in their indicators

By reconciling available sources and incorporating industry expert feedback, the Guide estimates the following figures:

The data on CTs shows 1,275 CT units installed in Spain, based on COCIR data, which comes from the installed base documented by the industry, plus the 40 expansion units tendered by InvEAT. Furthermore, InvEAT data accurately reflects the publicly owned units (676 units), so an estimated 599 privately owned units can be attributed to the total as of December 2023.

In MRI, the data increases because COCIR data does not include open MRIs, so the estimate of 1,200 units is more realistic, with 403 units being publicly owned, including the 90 new machines acquired by InvEAT. The number of units in private practice is estimated at 797.

For calculating the number of Radiology Angiographs (ASD), the data from the Ministry's records are more specific, since neither the OECD nor COCIR reports them in a disaggregated manner.

Thus, COCIR includes Angiographs and Hemodynamics and Electrophysiology Units in its data, which are not included in this study. The fact that any ASD installation must be installed in an inpatient center with Critical Care services for emergencies allows us to estimate that the 283 units registered in the CNH 2020 are an excellent reference due to their specificity and include both the public and private sectors. To the units existing in 2020, we must add the 29 units considered as expansions in InvEAT, plus 8 units developed in new centers deployed in private medicine.

Therefore, we agree on a total of 320 ASD systems installed in Spain, of which 211 are publicly owned, and these are the ones documented in InvEAT.

Thus, the most accurate estimate of the inventory in Spain of diagnostic imaging and interventional equipment, specifically MRI, CT, and angiographs for radiology, as of December 2023 is:

Estimated Inventory of Medical Imaging (CT-MRI- Angio) in Spain (December 2023)

Units	Total	Public	Private
CT	**1.275**	676	599
MRI	**1.200**	403	797
ASD/DSA	**320**	211	109

Table 7
Source: *Prepared by the authors based on the sources shared in this Annex*

ANNEX II
Evolution of Obsolescence 2014 – 2025

From 2009 onwards, the financial crisis triggered a global slowdown. In Spain, this caused an unprecedented halt in public-sector investments, particularly through freezing of capital expenditure budgets, severely affecting healthcare technology renewal.

This Annex provides a historical perspective based on multiple sources, linked to economic circumstances and significant technological innovations, without aiming to be exhaustive.

Computed Tomography (CT):

The reduction in investment in new systems from 2012, reaching a minimum in 2016, drove ageing of the installed base and led to up to 35% of CT systems being older than 10 years by 2020.

Over the decade, technology evolved from a focus on 16-slice systems (2014) to widespread 64-slice systems from 2016, with advanced post-processing for coronary CT angiography, stroke and cancer becoming standard.

The EURATOM Directive (mandatory from 2018) emphasized measurement and traceability of patient radiation impact; technology responded with dose reductions approaching 80% versus previous generations.

However, renewal investment remained insufficient to replace >10-year systems, which deliver higher radiation doses.

Private investment surpassed public investment in certain years and again from 2023–2025.

Investment in Nr of Units of CT in Spain. Trend 2014-202

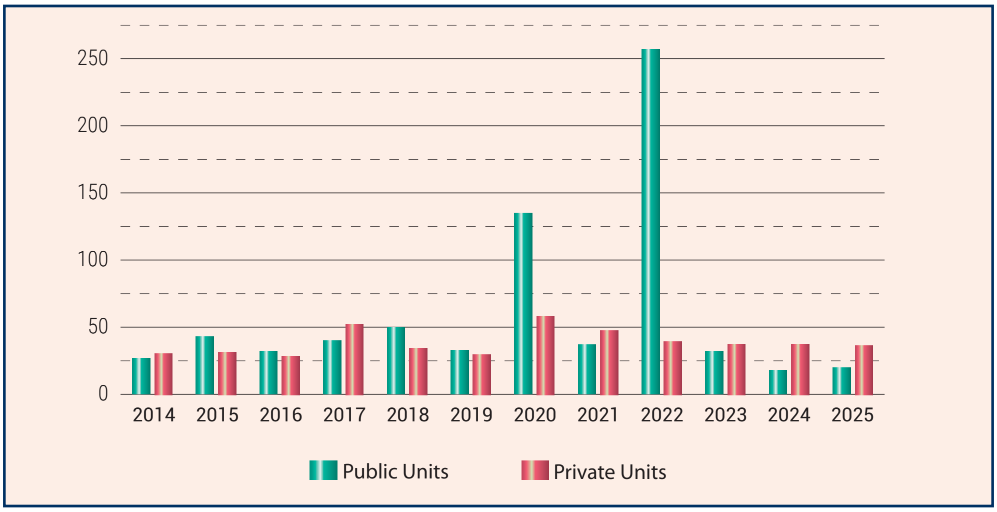

Chart 9
Source: *FENIN Market Data 2014-2023*

In 2018, the first Amancio Ortega Foundation donation boosted oncology diagnostic capability, slightly increasing CT acquisitions compared to previous years. In the comparative results of COCIR, that year Spain was the second to last country in Europe in terms of the proportion of CT scanners less than 5 years old and the third among European countries with the oldest CT scanners, according to the Age Profile 2019.

In 2020, two extraordinary circumstances produced major investment: Andalusia awarded a contract to install 85 CT systems through an availability service model, and the COVID diagnostic circuit and VAT removal for related acquisitions boosted purchases across sectors. InvEAT in 2022 renewed 209 old public CT systems and expanded by 47 units.

In the period from 2014 to 2023, which is the one we are analyzing, the number of devices available in Spain has increased from 833 units in December 2013 to 1,275 installed devices at the end of 2023. The equivalent compound annual growth rate reaches 5% per year, which is consistent with the demand increase of CT tests.

CT Age Profile Evolution in Spain

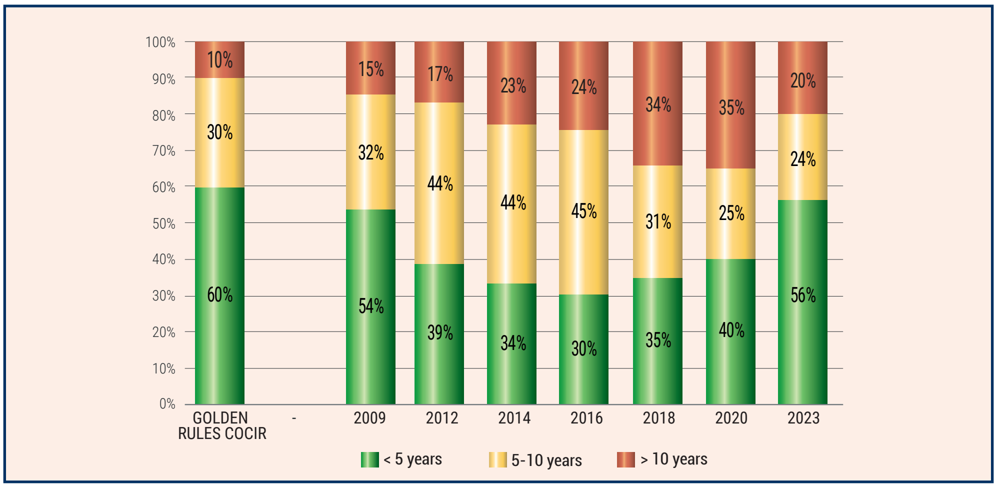

Chart 10
Source: *Fenin Hospital Age Profile 2023*

According to the data collected in this Guide, the Obsolescence Profile of TCs at the end of 2023 by asset ownership is as follow:

CT Age profile. Spain Dec. 2023

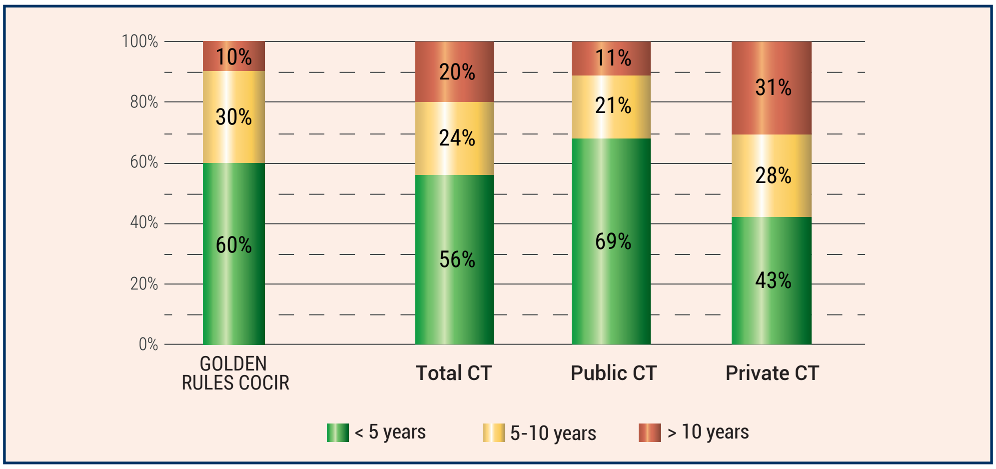

Chart 11
Source: *Prepared by the authors based Annex I and InvEAT Plan*

Magnetic Resonance Imaging (MRI)

The 2008 crisis also affected MRI investment in the SNS and the private sector, which accounts for nearly 65% of the installed base. From 2014–2017, public investment was constrained; in 2018 the FAO donation triggered modest MRI acquisitions in the SNS, while private providers often invested in refurbished systems and upgrades retaining the magnet. 1.5T systems consolidated, while 3T acquisitions were limited and often research-oriented and neurological applications.

In 2020, investment slowed because MRI was not central to COVID diagnosis, but demand grew for wider-bore systems (70 cm) and advanced applications (cardiac, vascular, breast, prostate).

Investment in nr of units of MRI in Spain. Trend 2014-2023

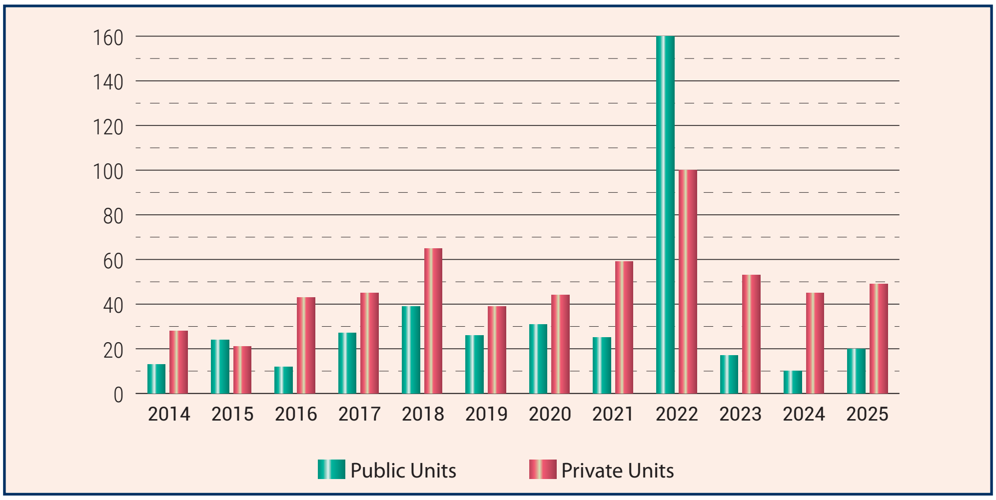

Chart 12
Source: *FENIN Market Data 2014-2025*

From 2021, private demand increased due to growth in private insurance as well as imaging test outsourcing from public institutions to address diagnostic waitlists growth caused by the stop of activity during pandemic.

The most significant year for investments in this area is 2022, when the InvEAT Plan addresses the renewal and replacement of all MRI machines older than 12 years in the National Health System (NHS). This coincides with an increase in the private market driven by a substantial rise in demand for services, primarily concentrated by private hospital chains. The 70 cm wide tunnel is consolidated, AI solutions are implemented in image processing, and there is a growing awareness of environmental sustainability aspects associated with this equipment.

The age profile of Magnetic Resonance Imaging in Spain has evolved according to the following table:

MRI Age Profile evolution in Spain

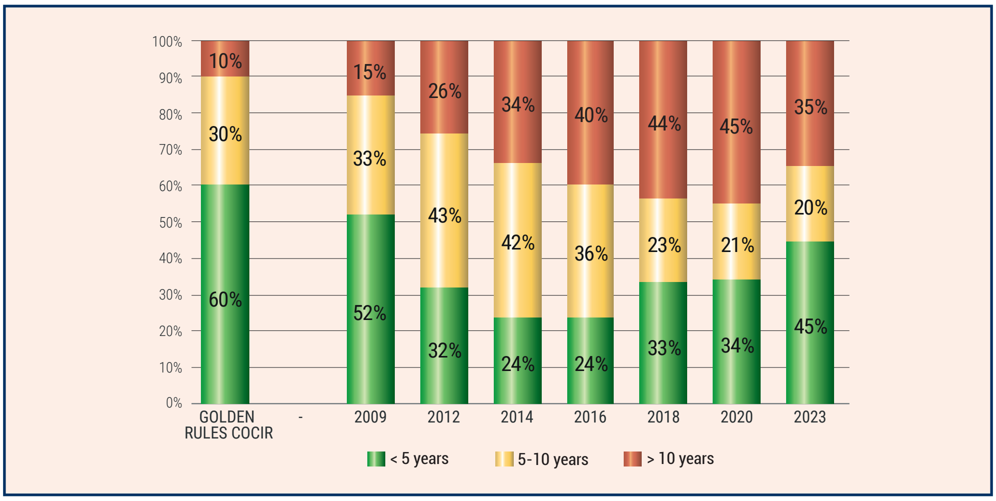

Chart 13
Source: *Fenin Hospital Age Profile 2023*

The growth in the number of MRI systems between 2013 and 2023 has meant going from 770 units available in 2013 to 1,200 MRI systems installed as of December 2023. This would be equivalent to a compound annual growth rate of 5.5% in the number of units available.

In the case of RM, the segmentation by ownership reflects that 64% of the installed units are privately owned. Thus, the obsolescence profile corresponds to the following graph:

MRI Age profile. Spain Dec. 2023

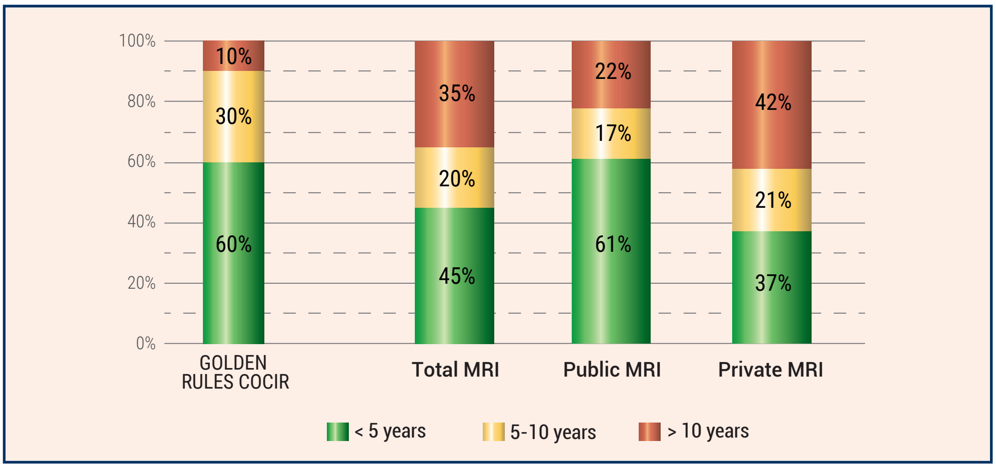

Chart 14
Source: *Prepared by the authors based Annex I and InvEAT Plan*

Angiography (DSA/ASD)

The evolution of investments in these imaging modalities is represented in Chart 15, which reflects the annual units acquired by asset ownership (includes aggregated units from Radiology, Vascular, Neurology and Cardiology):

Investment in Nr of Units of Angiography (Rad + Card) in Spain. Trend 2014-2023

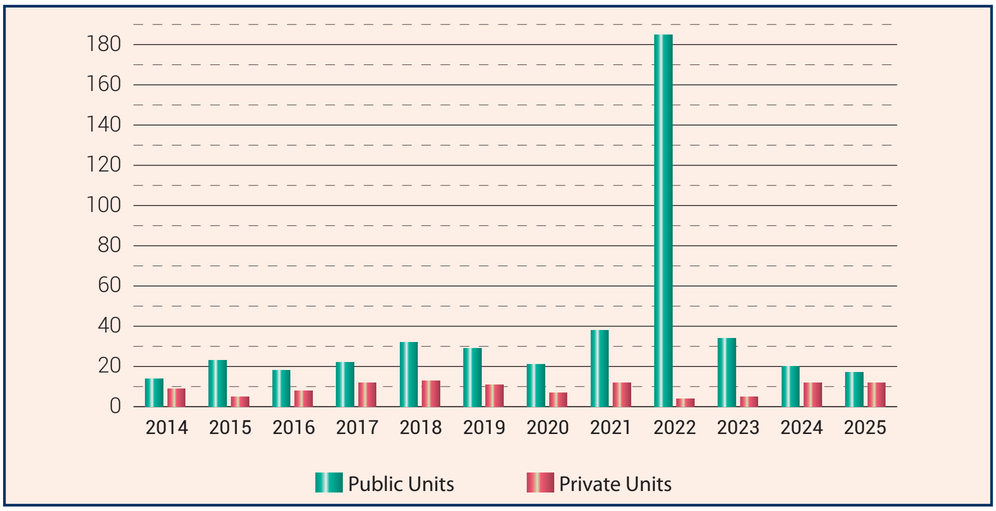

Chart 15
Source: *FENIN Market Data 2014-2023*

Market studies typically aggregate interventional imaging systems, combining radiology neuro/vascular suites with hemodynamics and electrophysiology. Where specific data are unavailable, this Guide assumes radiology-specific ASD/DSA accounts for 50% of total interventional systems by unit count.

This technology is predominantly publicly owned and installed in centers with critical care or emergency capacity. Application evolution during the period includes hybrid operating rooms and, from 2016, increased demand for real-time planning and guidance tools, image fusion and procedure support.

Age profile trend is the following:

ASD/HEM Angiography Age Profile Evolution in Spain

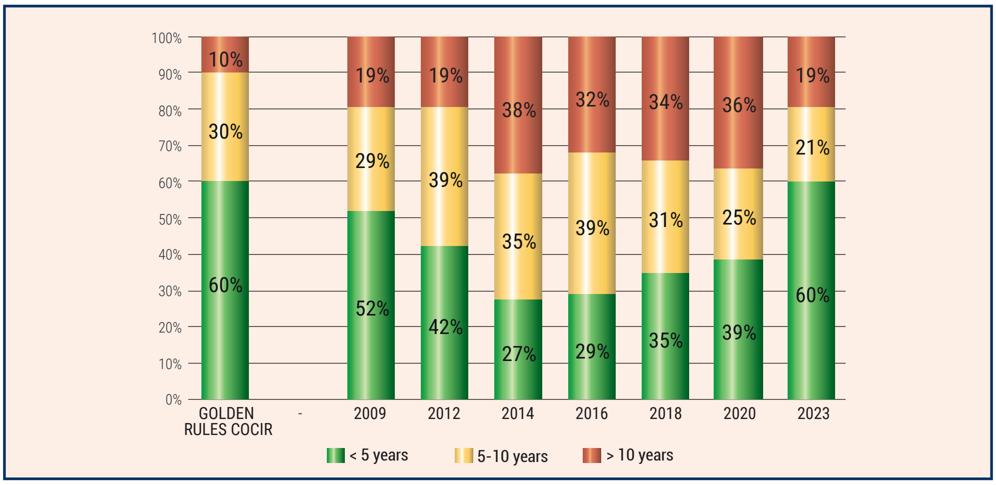

Chart 16
Source: *Fenin Hospital Age Profile 2023*

Likewise, the year 2019 was characterized by an increase in Biplane equipment for neuroradiology, resulting from the expansion of care models focused on cerebrovascular diseases, such as the Stroke Code.

In 2020, figures returned to those of previous years, driven by the freeze on investments in non-pandemic-related technologies, which also led to a halt in interventional procedures. The increase in the waiting list for interventional procedures was the reason why investment resumed in 2021 to provide additional capacity to meet the increased demand.

We can observe the very high concentration of equipment purchases in 2022, driven by the InvEAT Plan, which breaks with the investment trend of this decade.

Considering identical segmentation between ASD and Hemodynamics equipment, the data on the obsolescence profile of Radiology Angiography equipment is as follows:

ASD Age Profile. Spain Dec. 2023

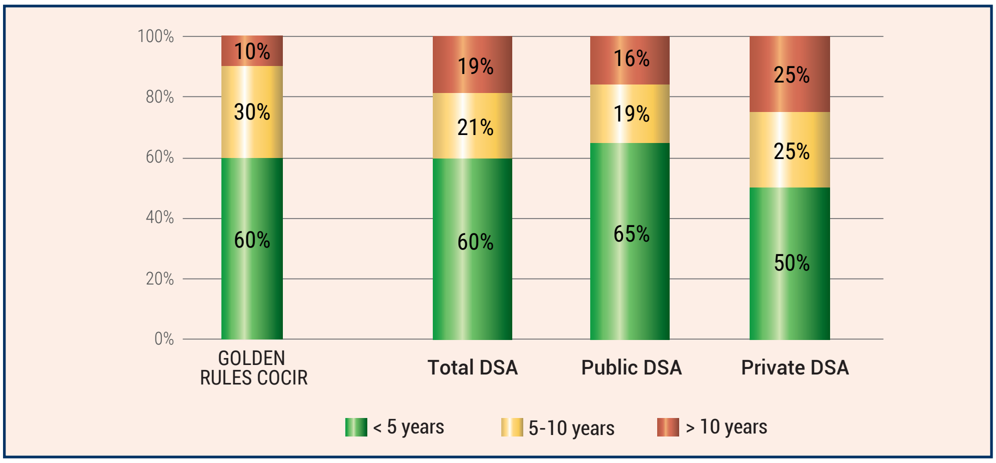

Chart 17
Source: *Prepared by the authors-based on Annex I and InvEAT Plan*

As additional information, we can indicate that 40% of privately owned equipment are mixed systems, where interventional procedures are performed in both Vascular Radiology and Cardiology..

X Ray Systems

This section includes X-ray rooms, remote-controlled tables and portable systems. Investment tracking is difficult given that it covers multiple technological bands and a high fragmentation of facilities, from a university hospital center to local health centers, in the public system, as well as diagnostic centers and private clinics of very different profiles.

We include this section to present the evolution of obsolescence, documented in FENIN studies, and to highlight the need for action to ensure that systems are upgraded to safer equipment with greater control over radiation dose.

X Ray Systems Age Profile evolution in Spain

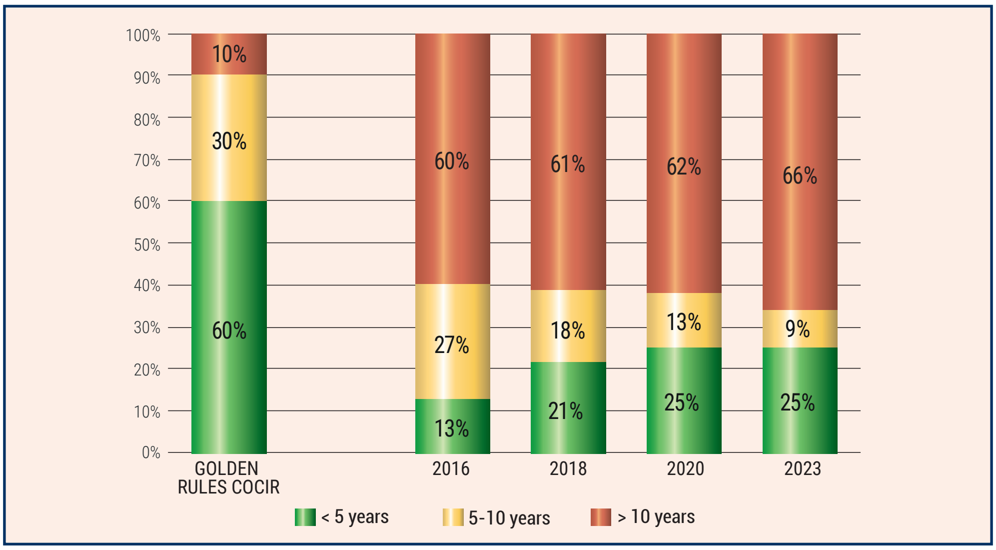

Chart 18
Source: *Fenin Hospital Age Profile 2023*

It is from 2023 onwards, with the framework agreements contained in the AMAT-I program, that the necessary renewal of very outdated equipment begins to be addressed.

Regional initiatives in some Autonomous Communities also begin in 2023 with investments supported by European Funds, such as in Andalusia. However, the impact on the installed base will not be seen until 2024, which is when most of the orders agreed upon at the end of 2023 are placed. For this reason, this impact is not reflected in Figure 18, which shows the evolution of the Technological Profile of X-ray systems up to 2023.

ANNEX III
International perspective: technology management models

The SERAM 2017 Guide included international references on technology lifecycle management in radiology. In this new edition, the Guide reviews and updates these references, removing the United States and incorporating France and Italy, which are closer to Spain's healthcare model.

It is obvious that provision and financing models affect the management criteria of technology, especially in those cases where attracting patients, with reimbursement per procedure, allows accelerating the Return on Investment (ROI), like a private insurance system, but the cases referred to here all have dominant public insurance systems.

III.1. Canadá

The Canadian Guide, already referred to in the SERAM 2017 Guide, established very comprehensive recommendations for planning and addressing the renewal of medical imaging technology. Its tables on renewal criteria, which consider years of service life and intensity of use, have served as a reference for the SERAM Guide and for defining the criteria of the InvEAT Plan.

In Canada, there is a process for monitoring the installed base of medical imaging equipment, managed by the Canadian Agency for Drugs and Technologies in Health (CADTH), through the creation, in 2015, of a documentary process to monitor, compare and define trends related to the availability, distribution, technical specifications and use of structural medical imaging equipment. This is the so-called **Canadian Medical Imaging Inventory (CMII)**.

The estimation effort carried out in this guide using dispersed data sources only reinforces the value of this initiative and the appropriateness of having a similar system in Spain. The monitoring and follow-up model have made it possible to identify deviations from the recommendations of the guides. Thus, CADTH published a document in 2021 warning of the potential impact on outcomes and quality of care in view of the ageing trend of medical imaging technology following Covid (Ref 8). Likewise, the Canadian Association of Radiologists reported this divergence from the Canadian Guide through different media outlets (Ref 9).

The CMII report, published in August 2024 (Ref 10), provides exhaustive documentation of available equipment, territorial distribution, age, utilization (number of examinations), ownership and other data, offering very complete information to analyze the status and use of structural medical imaging technology. This comprehensive study reflects a significant ageing rate in Canada's medical imaging equipment inventory, with one in three installed systems being ten years old or more. It also warns of the need to ensure the availability of professionals for the implementation of new equipment and highlights the need to increase equipment density in certain provinces, particularly given long distances and access difficulties.

The complete inventory of medical imaging equipment in Canada is publicly available via a website that allows access to discrete data in Power BI format: *https://www.cda-amc.ca/canadian-medical-imaging-inventory-cmii*

III.2. Australia

Australia's publicly funded healthcare system is primarily managed by its six states. The SERAM 2017 Guide described the imaging technology management process in Australia, highlighting well-defined procedures that provide a 360-degree view of asset status and renewal justification when applicable. States such as Victoria have developed sophisticated processes covering all healthcare technology assets, with programs strongly focused on the development of "business cases" to justify investment (Ref 11). Others, such as Western Australia, have established differentiated acquisition and renewal models for medical imaging technology compared with other healthcare technology assets (Ref 12). The medical imaging equipment replacement program includes X-ray-based equipment, including mammography and orthopantomography systems, fluoroscopy, angiography, computed tomography, magnetic resonance imaging, nuclear medicine (PET-CT) and ultrasound. Recommended periods of use are defined according to the criteria set out in Table 8 of the Guide.

Western Australia introduces the concept of Maximum Extended Life, which is only applicable if the equipment has received a "relevant upgrade". While not common practice due to increased clinical and patient safety risks, this concept may become relevant if European sustainability regulations require the adoption of such strategies.

Equipment age has a direct impact on reimbursement. The Australian Department of Health does not reimburse the cost of imaging examinations if the equipment has exceeded its recommended useful life, except in the case of PET-CT systems. This approach, known as 'capital sensitivity', is intended to incentivize the replacement of equipment older than ten years (six years in the case of ultrasound) and to promote the adoption of innovative technologies accessible to patients. (Ref 13)

One of the current areas of concern in Australia is access to diagnostic imaging equipment, given the country's vast geography and uneven population density.

Life Cycle Medical Imaging Technology in Western Australia

Equipment Modality	Recommended Useful Life	Maximun Extended Life Age*
Angiography	10 years	15 years
CBCT	10 years	15 years
Computed Tomography	10 years	15 years
Diagnostic Tomography (X-ray)	10 years	20 years
Fluoroscopy	15 years	20 years
Mobile Fluoroscopy	10 years	20 years
Multi-purpose Fluoroscopy whith Angiography capability	10 years	20 years
Mammography	10 years	15 years
MRI	10 years	20 years
Nuclear Medicine	10 years	15 years
Nuclear Medicine with Diagnostic CT	10 years	15 years
Orthopantomogram (OPG)	10 years	20 years
Ultrasound	6 years	15 years

* Extension of recommended useful life is not a common practice as it leads to increased risk to clinical and patient safety. Most of the equipment have no upgrade option.

Table 8
Source: *Ref 12 "Medical-Equipment-and-Imaging-Replacement-Program-Guidelines". Pag 10*

The Australian Society of Medical Imaging and Radiation Therapy (ASMIRT) submitted a proposal to the Australian Senate highlighting disparities in access to imaging equipment and proposing a service-based model structured around seven types of healthcare facilities to address diagnostic demand based on geographical accessibility (Ref 14)

This initiative, which the government responded to at the end of 2018 (Ref. 15), remains one of the areas of concern today due to the difficulty of covering the territories of central and western Australia with medical imaging resources.

III.3. United Kingdom (UK)

The United Kingdom's National Health Service (NHS), together with the National Institute for Health and Care Excellence (NICE), has produced numerous publications related to imaging technology management, particularly regarding its impact on care processes and specific clinical use. Although no specific guideline has been published defining recommended renewal timelines, general lifecycle recommendations range from five to seven years for ultrasound systems and up to ten years for more complex diagnostic imaging systems.

In 2019, NHS England published the 'Transforming Imaging Services in England: A National Strategy for Imaging Networks' (Ref 16), which sets out a major transformation in the structural organization of diagnostic imaging services through the integration of healthcare providers into imaging networks. The strategy envisaged the integration of the 151 Trusts and Foundation Trusts in England into 18 imaging networks by 2023, enabling coordinated and interoperable working models. The objective is to share technological assets, deploy diagnostic centers closer to patients, balance workloads and specialization, and enable ubiquitous access to imaging and reports by healthcare professionals, thereby improving working conditions, activity levels and response times.

To support this transformation, NHS England developed the 'Capital Equipment Planning Guide' (Ref 17), in collaboration with the Royal College of Radiologists, the Society of Radiographers and the Institute of Physics and Engineering in Medicine. This guide presents innovative access models ranging from traditional asset acquisition to service availability models that may include diagnostic equipment, information systems and, where necessary, infrastructure. Equipment replacement should follow the recommendations of the European Society of Radiology (ESR), which sets a ten-year renewal period and allows depreciation to be applied in financial statements, including provisions for amortization, thereby supporting financial continuity in replacement cycles.

The health systems of Scotland (NHS Scotland) and Wales (NHS Wales) have followed a similar integration model, at least with regard to the creation of the technological macrostructure (PACS) required for the ubiquitous exchange of images and reports across NHS systems.

III.4. France

France was not addressed in the 2017 Guide; however, it represents a very specific model for the management of diagnostic activity and technology. The French healthcare system is universally covered, financed through social contributions and the State, with a mixed public–private provision model that allows free choice of physician and healthcare center. It is managed through the Carte Vitale, which facilitates reimbursement (80–100%) of medical expenses, commonly complemented by private insurance (Mutuelle) to reach full coverage.

Approximately 90 million diagnostic imaging examinations (X-ray, CT and MRI) are performed annually in France, reaching a reimbursement value of nearly €2.2 billion (Ref 18). In ultrasound, 34 million acts are performed annually, amounting to an additional €1.657 billion.

There are around 9,000 practicing radiologists in France, 57% of whom work in private practice (libéraux), with approximately 1,600 working in mixed settings.

The diagnostic imaging model is highly regulated and planned. The installation of a new MRI, CT, PET or X-ray system requires explicit approval from the Regional Health Agency (ARS), validated according to existing and forecast demand, to ensure a minimum activity flow per system, whether public or private.

The health system uses a medical act coding model (CCAM) that structures reimbursable acts and the official price paid by the Assurance *Maladie*. This payment is the **forfait**: a fixed, predefined payment per medical act, regardless of the actual cost, regulated by law under the principle of activity-based payment (*tarification à l'activité*, T2A). Tariffs vary according to equipment age (maximum seven years for CT and MRI), activity volume and location (Ref 19).

The diagnostic test pricing model, in a system of free choice of provider by the patient, has created a mixed provision model for diagnostic imaging tests. Thus, the pricing conditions are identical for public and private providers, generating competition in quality when a patient decides which provider to use, while maintaining the same standards of innovation and technology for both types of provision (dose reduction, equipment age, etc.).

The number of installed MRI and CT scanners in France reaches 1,300 MRI and 1,450 CT. In the case of angiography equipment, France exceeds the European average, reaching around 2,400 interventional systems, of which we can attribute approximately 1,100 units to vascular and interventional radiology.

As a result of this tariff-based model, the obsolescence profile of CT and MRI in France is among the lowest in Europe, with frequent replacement of equipment at around seven years.

The pricing model is undergoing a downward revision following the official decree published in November 2025, which revises the applied fees and reduces the rates for second tests. This new situation can be found in the following news item (Ref. 20).

III.5. Italy

Italy has a healthcare system very similar to Spain's, with predominantly public providers serving National Health Service demand and private providers that may contract with the system or operate independently. The predominant acquisition model for diagnostic imaging technology in the public system is the framework agreement, managed by CONSIP, the national central purchasing body under the Ministry of Economy and Finance (Ref 21).

This allows any Italian public hospital to acquire MRI or CT technology directly from a pre-negotiated catalogue, ensuring competitive prices and standardized technical specifications.

Likewise, there are regional framework agreements that cover these same aspects or complement applications and equipment not included in the national framework. This format has already been tested in Spain in the InvEAT Plan and continues to be used in subsequent programs (AMAT-I), where, as mentioned in previous sections, it is highly valued by technologists, healthcare professionals, and procurement officers.

CONCIP Procurement follows the criterion of the Most Economically Advantageous Tender, reducing the weight of price to around 30–40% and prioritizing technical quality, after-sales services, ergonomics, patient experience and environmental criteria, aligned with EU "Smart Procurement" standards

Within the context of European funding, Italy must replace all medical imaging equipment older than ten years before the end of 2026, maintaining a renewal criterion aligned with other European countries.

III.6. COCIR

COCIR maintains the 'Golden Rules' as a recommendation for managing the lifecycle of medical imaging technology assets (Ref 22), which provide the reference standard for age profiles used in this Guide used to compare obsolescence status:

• At least 60% of equipment should be less than five years old. These reflect the most current and innovative technology that offers better results and value for the patient (radiation dose, scan times, diagnostic effectiveness) and allows for the incorporation of the latest technological updates at a reasonable cost.

• No more than 30% should be between six and ten years old. Being in maturity they still provide the expected diagnostic value, as long as there has not been any disruptive innovation that justifies their replacement.

• No more than 10% should be over ten years old. It is a period where the core technology of these devices is outdated and obsolete, it may even be unsuitable for certain procedures, making their maintenance more expensive and increasing the risk of cybersecurity breaches.

Furthermore, the relevance of digital systems for medical image management, access, and distribution must be considered as an integrated ecosystem to ensure compatibility, interoperability, and security among all devices connected to them. Thus, the use of standards and the continuous updating on base software components for the different elements that comprise it (networks, computers, equipment, consoles, etc.) are fundamental.

III.7. Emerging sustainability criteria for equipment acquisition

Environmental sustainability criteria are increasingly influencing public procurement decisions. The EU is promoting green public procurement to encourage more sustainable technologies and manufacturing practices. In imaging technology, simplified criteria focused only on nominal electricity consumption can be misleading, as higher consumption may correlate with shorter exams; more appropriate criteria should consider manufacturing footprint, recyclability, consumables per process, chemical use and broader impacts.

MEPA (The Medical Equipment Proactive Alliance for Sustainable Healthcare), with partners including COCIR, MedTech Canada and ESR, has developed guidance on “Sustainability criteria for diagnostic imaging equipment procurement” (Ref 23).

This document reinforces the need to standardize the criteria for assessing environmental parameters in diagnostic imaging equipment, focusing especially on sustainability parameters in the manufacturing and use process, analyzing both the company’s sustainability performance and the product’s sustainability performance based on four areas:

- Climate change mitigation
- Sustainable use of resources
- Use of polluting chemical substances
- Social impact

ANNEX IV
Summary of the 2017 SERAM Guide

The main contributions of the 2017 SERAM Guide were as follows:

- Confirmation of the state of obsolescence of Medical Imaging (MI) technology assets, which had already been documented by other sources, through a survey conducted among public hospitals with more than 250 beds.
- A concise analysis of international references on the management of the life cycles of diagnostic imaging technology.
- The provision of documentary references on management models and data describing the status of medical imaging technology.
- The establishment of standards for renewal criteria based on the analysis of healthcare systems comparable to the Spanish system, such as the Canadian Guide.

The main conclusions of the SERAM 2017 Guide were the following:

- It is necessary to develop and maintain a comprehensive registry of all equipment, including complete information on costs, condition and level of activity.
- Equipment renewal should be standardized based on years of use and intensity of use, according to the following framework:

SERAM 2017 Guide. Proposal on the useful life of imaging technology

	Intensive use	Standard use	Low intensity of use
Basic X-ray room	10 years	12 years	14 years
RC Fluoroscopy	8 years	10 years	12 years
Radiosurgical C-arm	8 years	10 years	12 years
Mammography system	8 years	9 years	10 years
Ultrasound System	7 years	8 years	9 years
CT scanner	8 years	10 years	12 years
MRI system	8 years	10 years	12 years
Angiography System	8 years	10 years	12 years

Table 9
Source: *Guia SERAM 2017 (Ref 1)*

- Equipment must be properly maintained, including the implementation of recommended updates throughout its life cycle
- A strategic renewal planning process should be mandatory, incorporating a 3–5-year investment plan, to enable appropriate asset management and transparency to stakeholders.
- Models should be developed to ensure functionality, safety and technological updating, particularly when equipment exceeds the standard renewal period (> 10 years).

References

1. **Spanish Society of Medical Radiology (SERAM).** Guide for technology renewal and updating in radiology. Lifecycle management of diagnostic imaging technology.
   Authors: M.A. Trapero – I. López. 2017.
   Available: *https://www.fundacionsigno.com/archivos/20240207082254.pdf*
   (accessed 24 February 2026).

2. **Independent Authority for Fiscal Responsibility (AIReF).**
   SNS hospital expenditure. 2020.
   Available: *https://www.airef.es/wp-content/uploads/2020/10/SANIDAD/PDF-WEB-Gasto-hospitalario-del-SNS.pdf*
   (accessed 24 February 2026)

3. **Ministry of Health (Spain).** InvEAT Plan.
   Available: *https://www.sanidad.gob.es/profesionales/prestacionesSanitarias/PlanINVEAT/pdf/Plan_INVEAT.pdf*
   (accessed 24 February 2026).

4. **Ministry of Health (Spain).** SNS Health Information System: Hospitals.
   Available: *https://www.sanidad.gob.es/estadEstudios/estadisticas/sisInfSanSNS/ofertaRecursos/hospitales/home.htm*
   (accessed 24 February 2026).

5. **Fundación SIGNO. Technology management in radiology post-InvEAT.**
   Available: *https://www.fundacionsigno.com/archivos/Gestión_de_la_Tecnologia_en_Radiología_Post_Inveat.pdf*
   (accessed 24 February 2026).

6. **Fundación SIGNO.** Criteria for updating and renewing digital solutions in radiology.
   Available: *https://www.fundacionsigno.com/archivos/criterios-actualizacionrenovacion-soluciones-digitales-Radiología.pdf*
   (accessed 24 February 2026).

7. **Fundación SIGNO.** Procurement process for technology in radiology.
Available: *https://www.fundacionsigno.com/archivos/Proceso-de-Contratacion-deTecnologia-en-Radiología.pdf*
(accessed 24 February 2026).

8. **CADTH. Service age of imaging equipment. 2021.**
Available: *https://www.cda-amc.ca/sites/default/files/attachments/2021-11/cmii_service_age_of_imaging_equipment.pdf*
(accessed 24 February 2026).

9. **Newswire Canada.** Canada's medical imaging equipment is aging: we need to act now to address demand.
Available: *https://www.newswire.ca/news-releases/canada-s-medical-imagingequipment-is-aging-we-need-to-act-now-to-addressdemand-846778195.html*
(accessed 24 February 2026).

10. **NCBI.** Medical Imaging.
Available: *https://www.ncbi.nlm.nih.gov/books/NBK607341/*
(accessed 24 February 2026).

11. **Victorian Health Building Authority (VHBA).** Medical equipment replacement program.
Available: *https://www.vhba.vic.gov.au/health/equipment-engineeringupgrades/medical-equipment-replacement-program*
(accessed 24 February 2026).

12. **Government of Western Australia, Department of Health.** Medical Equipment and Imaging Replacement Program Policy.
Available: *https://www.health.wa.gov.au/About-us/Policy-frameworks/Infrastructure-Asset-Management/Mandatory-requirements/Medical-Equipment-and-Imaging-Replacement-Program-Policy*
(accessed 24 February 2026).

13. **Australian Government, Department of Health.** What we're doing about diagnostic imaging.
Available: *https://www.health.gov.au/topics/diagnostic-imaging/what-weredoing-about-diagnostic-imaging*
(accessed 24 February 2026).

14. **Parliament of Australia.** DocumentStore: Submission 561267.
Available: *https://www.aph.gov.au/DocumentStore.ashx?id=2cfdd6d5-dd684991-916a-3915953acc2e&subId=561267*
(accessed 24 February 2026).

15. **Parliament of Australia. Government response:** Senate Community Affairs Committee – Diagnostic Imaging.
Available: *https://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Community_Affairs/Diagnosticimaging/Government_Response*
(accessed 24 February 2026).

16. **NHS Improvement (UK).** Transforming imaging services. 2021.
Available: *https://webarchive.nationalarchives.gov.uk/ukgwa/20210401201200/ https:/improvement.nhs.uk/documents/6119/Transforming_imaging_ services.pdf*
(accessed 24 February 2026).

17. **NHS England.** Capital equipment planning guide. April 2021.
Available: *https://www.england.nhs.uk/wp-content/uploads/2021/04/B0030Capital-equipment-planning-guide-April-2021.pdf*
(accessed 24 February 2026).

18. **L'Imagerie en France.** État des lieux. Octobre 2023.
Available: *https://www.snitem.fr/wp-content/uploads/2023/10/Dossier-depresse-_ Limagerie-en-France.pdf*
(accessed 24 February 2026).

19. **République Française.** Arrêté du 2 février 2024
Available: *https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000049092554*
(accessed 24 February 2026).

20. **Radiologues:** baisse des tarifs à compter du 5 novembre 2025.
Available: *https://www.lofficieldesmetiers.fr/radiologues-baisse-des-tarifs-a-compter-du-5-novembre-2025 /*
(accessed 24 February 2026).

21. **Consip S.p.A.** Programme 2023.
Available: *https://www.consip.it*
(accessed 24 February 2026).

22. **COCIR.** Medical Imaging Equipment Age Profile & Density. 2021 Edition.
Available: *https://dev.cocir.org/wp-content/uploads/COCIR_Medical_Imaging_ Equipment_Age_Profile_Density_-_2021_Edition-1.pdf*
(accessed 24 February 2026).

23. **MEPA Alliance.** Homepage.
Available: *https://www.mepaalliance.org/*
(accessed 24 February 2026).

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