

ASEAN Movement in Radiology

Magnetic resonance imaging capacity expansion in Vietnam: National import trends and implications for health system planning (2023–2025)

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Abstract

Background: Magnetic resonance imaging (MRI) is a core diagnostic modality supporting advanced clinical service. In Vietnam, increasing healthcare investment has driven expansion in MRI capacity, yet comprehensive multi-year analyses remain limited.

Objective: To analyze MRI system, import trends in Vietnam from 2023 to 2025, focusing on MRI capacity expansion, technology diffusion, regional distribution, and implications for health system planning.

Materials and Methods: National import data on MRI systems from 2023 to 2025 were reviewed and classified by year, magnetic field strength, manufacturer, region, and type of healthcare provider. Descriptive analyses were performed to evaluate temporal trends and market characteristics.

Results: A total of 257 MRI systems were imported during 2023–2025. The 1.5T MRI remained dominant, accounting for 67.3% of the imported systems, while 3.0T systems increased markedly from 6 units in 2023 to 22 units in 2025. In 2025, Northern Vietnam accounted for 71.6% of newly imported 1.5T and 3.0T systems. Private healthcare providers represented 50.0% of installations and showed a higher proportion of 3.0T adoption than public hospitals. Distribution of imported MRI systems by manufacturer was significantly uneven ($\chi^2 = 105.36$, $df = 5$, $p < 0.001$), with manufacturers GE and Siemens together accounting for 62.2% of imported MRI systems.

Conclusion: Vietnam's MRI diagnostic capacity continues to expand rapidly with a clear shift toward higher-field MRI technologies. This evolution underscores the need for strategic imaging investment and coordinated health system planning, in Vietnam and the wider ASEAN region.

Keywords: ASEAN, Diagnostic capacity, Field strength, Health policy, Health system planning, Magnetic Resonance Imaging, MRI imports, Technology diffusion, Vietnam.

Introduction

Magnetic resonance imaging (MRI) has revolutionized diagnostic medicine, establishing itself as an indispensable tool for non-invasive evaluation across oncology, neurology, and musculoskeletal disorders [1,2]. As global healthcare systems evolve, the demand for high-resolution imaging infrastructure has expanded exponentially, particularly in emerging market economies within the Asia Pacific region [3,4]. Driven by macroeconomic growth, expanding health insurance coverage, and a demographic shift toward an aging population, Vietnam represents one of the fastest-growing medical device markets in Southeast Asia [5,6]. Beyond its diagnostic value, MRI represents a major health technology investment that reflects the technological maturity of healthcare systems. The adoption and diffusion of advanced imaging technologies are increasingly used as indicators of healthcare modernization and system capacity development. Health technology assessment (HTA) frameworks emphasize that medical equipment deployment should be evaluated not only from technical and clinical perspectives but also from organizational, economic, and policy perspectives [7,8].

Historically, the procurement of advanced diagnostic equipment in middle-income countries has faced significant structural constraints, including high capital expenditure, infrastructure limitations, and a shortage of specialized biomedical personnel [2]. However, recent clinical shifts emphasize a transition from lower field strengths toward

high-field configurations, such as 1.5T and 3.0T systems, which offer superior signal-to-noise ratios, shorter scan times, and enhanced functional imaging capabilities [7]. Understanding MRI adoption patterns may provide evidence for national imaging capacity planning, health technology prioritization, and equitable allocation of diagnostic resources across regions. Health technology assessment literature recognizes diffusion patterns of medical devices as an important component of healthcare planning and policy development. Evaluating the distribution of MRI technology may therefore contribute to evidence-based decision-making for future healthcare investments [9]. Despite the strategic importance of this technology, public empirical research tracking multi-year biomedical import trends, distribution equity, and private versus public purchasing behaviors in Vietnam remains scarce. This study analyzes comprehensive national MRI import datasets from 2023 to 2025 to evaluate growth patterns, technological composition, geographic distribution, and market shares among primary manufacturers, establishing an empirical baseline for healthcare infrastructure planning. In addition, this study provides evidence to support health system planning, equitable allocation of diagnostic imaging resources, and future public health policy in Vietnam. By situating MRI market dynamics within broader health system needs, the findings contribute to strategic decision-making and long-term capacity building in diagnostic imaging services.

Materials and methods

Official national import statistics were analyzed descriptively. MRI systems were classified by year of import, magnetic field strength (<1.5T, 1.5T, and 3.0T), and manufacturer. Import data were obtained from the official Vietnam Customs database using MRI-related HS codes 90181300. Access to the dataset was granted through formal authorization, and the data were purchased from the Customs authority [10]. The dataset was subsequently cleaned and analyzed by the authors to ensure accuracy and consistency.

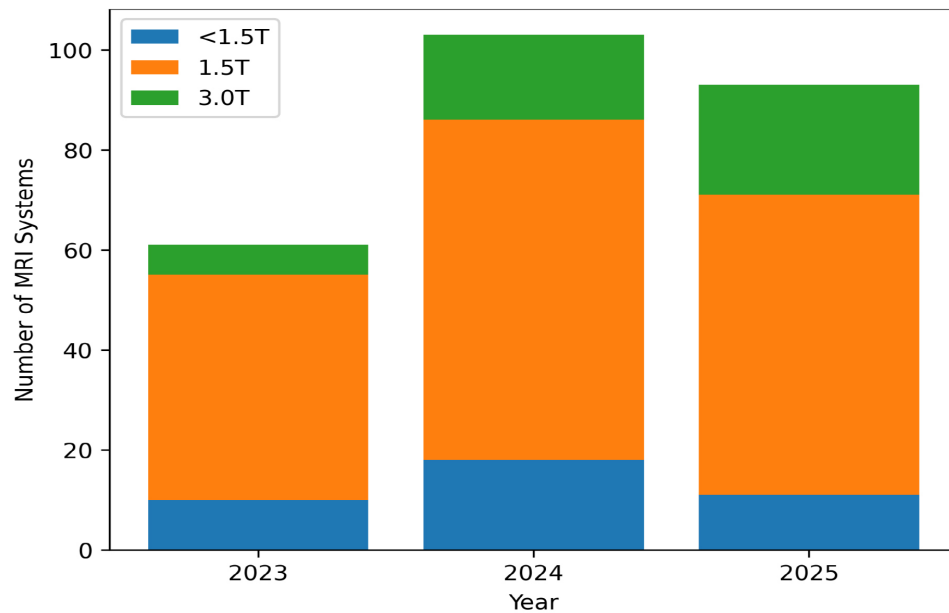
Descriptive analysis was performed to examine trends and the market structure of imported MRI systems. Statistical analyses were conducted using R software (version 4.3.2; R Foundation for Statistical Computing, Vienna, Austria). MRI system categories—defined by magnetic field strength (<1.5T, 1.5T, and 3.0T) and manufacturer—were treated as categorical variables and summarized as frequencies and percentages by year. Differences in the distribution of MRI system categories across years (2023–2025) and manufacturers were assessed using the chi-square test of independence.

Results

A total of 257 MRI systems were included in the analysis, with annual imports increasing from 61 systems in 2023 to 103 systems in 2024, followed by a slight decline to 93 systems in 2025.

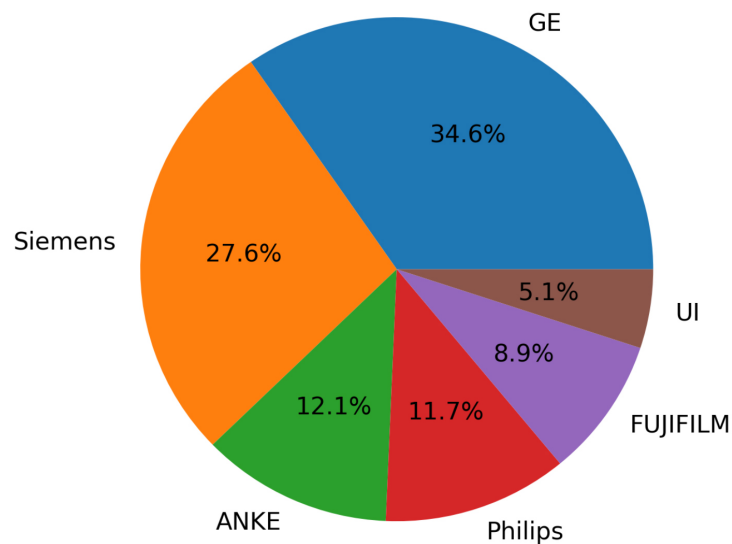
- **Field-strength distribution:** Across all years, 1.5T systems constituted the majority (173/257; 67.3%). The proportion of 3.0T systems increased progressively over time, reflecting a gradual technological shift toward higher-performance imaging platforms.
- **Manufacturer market share:** GE (89/257; 34.6%) and Siemens (71/257; 27.6%) together accounted for more than half of total imports (62.2%). Other contributors included ANKE, Philips, FUJIFILM, and United Imaging, each representing smaller but notable segments of the market.
- **Regional and ownership distribution in 2025**
Out of the 93 MRI systems imported in 2025, customs data confirmed the installation of 88 systems within the year. It is likely that five systems were imported toward the end of 2025 but only installed in early 2026, and therefore their locations were not included in the statistics.
Among the 88 installed systems, Northern Vietnam accounted for 63 units (71.6%), while Southern Vietnam accounted for 25 units (28.4%). Private health-care providers installed 44 systems (50.0%), with a higher proportion of 3.0T units (31.8%) compared to public hospitals (22.7%).

Comparative analysis using the chi-square test showed no statistically significant difference in the overall distribution of field-strength categories across the three years ($\chi^2 = 7.42$, $df = 4$, $p = 0.115$). Despite the lack of statistical significance, descriptive trends were evident. Specifically, the number of 1.5T systems peaked in 2024 before declining in 2025, while 3.0T systems demonstrated a steady increase across the study period. This pattern suggests a gradual transition toward higher-field MRI technology, consistent with global trends in advanced diagnostic imaging. In terms of manufacturer dynamics, GE and Siemens maintained dominant positions throughout, while emerging contributions from other vendors highlight a diversifying market landscape.



Year	<1.5T	1.5T	3.0T	Total
2023	10	45	6	61
2024	12	79	12	103
2025	8	49	22	93
Total	30	173	40	257

Figure 1. MRI imports in Vietnam by field strength (2023–2025). Stacked bar chart illustrating annual distribution of < 1.5T, 1.5T, and 3.0T systems. A progressive increase in 3.0T systems is observed over time.



Manufacturer	Share (%)	Number of Systems
GE	34.60%	89
Siemens	27.60%	71
ANKE	12.10%	31
Philips	11.70%	30
FUJIFILM	8.90%	23
United Imaging (UI)	5.10%	13
Total	100%	257

Figure 1. *Distribution of imported MRI systems by manufacturer (2023–2025 total). GE and Siemens together account for the majority of MRI imports, with additional contributions from ANKE, Philips, FUJIFILM, and United Imaging.*

The distribution of imported MRI systems differed significantly among manufacturers ($\chi^2 = 105.36$, $df = 5$, $p < 0.001$). GE accounted for the largest share of imported systems (34.6%), followed by Siemens (27.6%). Together, these two manufacturers represented 62.2% of all imported MRI systems, indicating a highly concentrated manufacturer market structure.

Discussion

The expansion of MRI infrastructure should be interpreted not only as technological growth but also as an indicator of strengthening diagnostic capacity within the Vietnamese health system. The Vietnamese MRI market demonstrates both quantitative expansion and qualitative technological transition. From a health technology assessment perspective, the observed increase in MRI installations reflects not only market growth but also accelerated adoption of advanced diagnostic technologies within the healthcare system. Technology diffusion is commonly influenced by clinical demand, investment capacity, organizational readiness, and expected healthcare benefits [9]. The increasing adoption of higher-field MRI systems may indicate growing demand for advanced diagnostic capability and greater investment in imaging infrastructure across Vietnam [7].

The data reveals a distinct divergence in procurement behavior between public and private healthcare facilities. The higher adoption rate of 3.0T MRI systems in the private sector may indicate greater flexibility in capital investment and faster uptake of emerging technologies. Similar patterns have been reported in health technology adoption studies, where private healthcare providers often serve as early adopters of advanced medical equipment due to fewer budgetary constraints and stronger competitive incentives [11,12]. This trend may contribute to technological innovation but could also widen disparities in access to advanced imaging services between healthcare sectors [9,12].

Policy Implications for Health Technology Planning

The empirical findings of this study yield several critical implications for strategic health technology planning, macro-level resource allocation, and healthcare policy formulation in Vietnam.

First, the profound surge in national MRI imports observed between 2023 and 2025 signifies an accelerating clinical demand for advanced diagnostic imaging modalities. This quantitative expansion aligns with the systemic modernization of Vietnam's healthcare infrastructure, the widespread institutionalization of imaging-guided clinical pathways, and rising consumer expectations for high-precision diagnostics. This rapid influx underscores the urgent need for evidence-based Health Technology Assessment (HTA) frameworks to systematically evaluate the clinical efficacy, cost-effectiveness, and long-term societal value of these capital-intensive investments [7,8].

Second, the stark geographical asymmetry in MRI procurement indicates latent regional disparities regarding patient access to high-tier diagnostic infrastructure. The disproportionate concentration of newly imported systems within Northern Vietnam in 2025, relative to the Southern and Central regions, poses a structural challenge to the

principle of healthcare equity. While this disparity is partially driven by localized macroeconomic variables and concentrated public-private hospital developments, it highlights the necessity for centralized regulatory oversight. Future provincial and national healthcare planning must utilize geographical information system (GIS) mapping of existing imaging density, regional disease burdens, and referral networks to establish a more balanced and equitable distribution of high-cost medical equipment [8].

Third, the rising trajectory of 3.0T MRI adoptions reflects a qualitative technological transition toward ultra-high-field imaging platforms. From a clinical governance perspective, while 3.0T configurations offer superior signal-to-noise ratios and advanced functional capabilities in neuroradiology, oncology, and cardiovascular imaging, they also demand substantial ancillary support systems. The diffusion of ultra-high-field MRI necessitates synchronized national investments in advanced pedagogical training for radiologists and biomedical engineers, rigorous quality assurance (QA) protocols, standardized safety guidelines (e.g., specific absorption rate [SAR] monitoring), and sustainable long-term lifecycle maintenance planning [7].

Fourth, the pronounced leadership of the private healthcare sector in absorbing 3.0T technologies demonstrates that private providers act as primary drivers and early adopters of disruptive medical innovations in Vietnam. Facilitated by flexible capital procurement models and strong market-driven competitive incentives, the private sector rapidly bridges the technological gap [11]. However, this asymmetric diffusion risks widening the quality-of-care gap between public and private tiers. Policymakers should devise strategic regulatory or public-private partnership (PPP) mechanisms to leverage private-sector imaging capacity, ensuring that low-income demographics can also benefit from advanced non-invasive diagnostics [12].

Finally, the sustained market concentration among a limited cohort of global medical device manufacturers (specifically GE HealthCare and Siemens Healthineers) presents both structural advantages and regulatory risks. While manufacturer concentration ensures high technological standardization, established maintenance ecosystems, and reliable technical support, it potentially limits long-term cost-optimization. Regulatory bodies and hospital procurement committees should maintain a transparent, highly competitive bidding environment to stimulate technological diversity, enhance cost-effectiveness, and maximize return on investment. Ultimately, this longitudinal analysis establishes that a laissez-faire approach to medical device procurement may exacerbate regional and cross-sectoral imbalances. Integrating systematic data-driven monitoring of health technology diffusion into national healthcare planning is paramount to achieving optimized resource allocation, safeguarding equity, and sustaining the modernization of diagnostic services across Vietnam [9,12].

Table 1. *Key findings, health technology implications, and policy recommendations for MRI capacity expansion in Vietnam (2023-2025).*

Core Empirical Finding	Strategic Health Technology Implication	Recommended Policy/Planning Intervention
Profound surge in national MRI imports (2023–2025)	Escalating clinical reliance on advanced diagnostics; rising infrastructure expenditure.	Institutionalize mandatory HTA guidelines for large-scale hospital capital equipment procurement.
Accelerated shift toward ultra-high-field 3.0T systems	Qualitative technological upgrading; expansion of high-precision subspecialty imaging.	Develop specialized workforce training programs and national MRI quality assurance protocols.
Private sector dominance in high-field (3.0T) adoption	Asymmetric innovation diffusion; private providers acting as early technological adopters.	Formulate strategic Public-Private Partnerships (PPPs) to enhance universal access to high-tier diagnostics.
Marked geographic clustering in Northern Vietnam (2025)	Severe regional polarization and potential inequities in diagnostic resource access.	Implement needs-based regional quota systems and capacity mapping for future import licensing.
Duopolistic market control by major global manufacturers	High technological standardization but restricted pricing competition.	Foster a transparent, competitive procurement environment to optimize capital expenditures.
Rapid nationwide expansion of total MRI infrastructure	Increased operational risks, lifecycle costs, and burden on technical personnel.	Mandate long-term total cost of ownership (TCO) evaluation and standardized safety frameworks.

MRI Capacity in Regional Context

MRI availability is commonly assessed using the number of MRI units per million population, an internationally recognized indicator of diagnostic imaging capacity. OECD data demonstrate substantial variation in MRI density across countries, ranging from more than 50 units per million population in Japan and over 30 units per million population in South Korea to considerably lower levels in many middle-income healthcare systems [13].

Although comprehensive national MRI inventory data are not currently available in Vietnam, the marked increase in MRI imports observed during 2023–2025 suggests ongoing expansion of national imaging capacity. Nevertheless, the concentration of newly installed systems in selected regions indicates that equitable access to advanced diagnostic imaging may remain an important challenge.

From a health technology assessment perspective, monitoring MRI density and geographic distribution is essential for optimizing healthcare resource allocation, reducing regional disparities, and supporting evidence-based planning of future imaging infrastructure. The findings of the present study provide an important foundation for future national assessments of MRI capacity and technology diffusion in Vietnam [8,13].

Future studies should estimate MRI units per million population and compare Vietnam with other ASEAN countries to support evidence-based health planning. Such comparative analyses would establish regional benchmarks, highlight disparities in diagnostic imaging capacity, and guide strategic investment priorities for Vietnam's healthcare system.

Limitations

This study has several limitations. First, the analysis relied exclusively on official import data from the Vietnam Customs database. While these records accurately capture the entry of MRI equipment into the market, they do not reflect real-world clinical utilization, patient throughput, or regional workforce capacity. Second, the dataset may not account for secondary market transactions, refurbished systems, or informal procurement channels. Classification was limited to field strength and manufacturer, with no information on coil configurations, software versions, or advanced imaging capabilities. Third, the study focused only on imports between 2023 and 2025, offering a short-term perspective on market dynamics; longer observation periods are needed to assess sustained trends. Finally, although descriptive and chi-square analyses provide useful insights into distribution patterns, more advanced econometric or longitudinal approaches would strengthen understanding of the causal drivers of MRI adoption in Vietnam and across ASEAN.

Conclusion

Vietnam's diagnostic imaging capacity (2023–2025) reflects rapid infrastructure expansion, marked by a strong shift toward 3.0T systems, significant private sector investment, and geographic concentration in the North. These dynamics highlight both opportunities and challenges for equitable access, sustainable financing, and workforce readiness. The trajectory toward higher field technologies underscores the need for strategic imaging investment, coordinated health system planning, and regional collaboration across ASEAN to ensure balanced distribution and long term healthcare equity.

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