Kasetsart Journal of Social Sciences 46 (2025) 460405

Kasetsart Journal of Social Sciences

journal homepage: http://kjss.kasetsart.org

Policy issues in promoting the adoption of artificial intelligence in Thai public hospitals

Kittisak Kaweekijmanee*,†, Kasemsarn Chotchakornpant†

Graduate School of Public Administration, National Institute of Development Administration, 148, Bangkok, 10240, Thailand

Article Info

Article history:
Received 15 March 2024
Revised 28 August 2024
Accepted 24 September 2024
Available online 10 October 2025

Keywords:
artificial intelligence,
innovation adoption,
public hospital,
technological innovation system

Abstract

This study investigates policy issues concerning the leveraging of AI potential to benefit healthcare services in public hospitals in Thailand. The study employs qualitative research methods and draws insights from in-depth interviews with 36 key informants involved in policy support, development, or implementation of healthcare-related AI innovations. The analysis of policy issues is facilitated using the technological innovation system (TIS) framework. The study identifies several issues including: inadequate mechanisms for effective innovation dissemination, market entry barriers, unclear legitimation processes for medical AI, resource inefficiencies, and ineffective translation of policy frameworks into practice in innovation activities. It shows how activities within the TIS influence the adoption of AI in public hospitals, by impacting innovation suppliers, users, and the mechanisms connecting the suppliers to broader user bases. The study has generated insights that benefit policymakers and relevant parties in designing better support for promoting the development and adoption of AI innovations in public health.

Introduction

The social and public health situation in Thailand necessitates improving healthcare service efficiency. With an aging population, healthcare expenditures are projected to triple from 539–633 billion baht in 2017 to 1,407–1,854 billion baht in 2032 (Thailand Development Research Institute, 2018). Thailand also faces a lower doctor–population ratio of 0.92:1000 compared to the World Health Organization benchmark of 1:1000 (Siripanumas et al., 2022), with physicians unequally distributed, particularly in rural areas due to heavy workloads. This leads to physician resignations from state hospitals, exacerbating the uneven distribution of the health workforce (Siripanumas et al., 2022). The scarcity of specialized medical professionals, such as radiologists, affects healthcare quality, especially in the timely interpretation of chest X-rays (Singweratham et al., 2021; Tangjai, 2020). Another example is the shortage of ophthalmologists, which results in delays in the diagnosis of diabetic retinopathy and age-related macular degeneration. This potentially leads to patients not receiving timely treatment and consequently experiencing vision loss (Tantibundhit et al., 2020).

* Corresponding author.
E-mail address: kittisak.kaweekijmanee@gmail.com (Kaweekijmanee, K.).
† Co-first authors.

https://doi.org/10.34044/j.kjss.2025.46.4.05
2452–3151/© 2025 Kasetsart University.

Artificial intelligence (AI) has been recognized in national policy documents as a crucial technology to help elevate the provision of medical services in Thailand. The 13th National Economic and Social Development Plan recognizes the development and utilization of AI as part of the strategy to leverage digital technology and information systems, to support medical services, improve efficiency, reduce workload, and address the shortage of medical personnel (Office of the National Economic and Social Development Council, 2023). In 2022, Cabinet of the Thai Government adopted a National AI strategy and Action Plan (2022–2027), the first national-level plan to outline comprehensive AI policies. The plan specifies the importance of AI applications in healthcare that Thailand should prioritize, notably AI for medical image diagnosis and telemedicine (Ministry of Higher Education, Science, Research and Innovation & Ministry of Digital Economy and Society, 2022). Recently, various types of AI have been applied in the area of public health in Thailand. For instance, since 2018, Google has partnered with the Department of Medical Services (DMS), under the Ministry of Public Health (MoPH) to develop AI to assist in diagnosing diabetic retinopathy. Since 2019, various chest X-ray interpretation AI technologies (such as AIChest4All, RAMA-AI, and Inspectra-CXR) have been developed by different organizations to aid in screening chest-related diseases such as tuberculosis, cancer, and COVID-19 pneumonia. Chulalongkorn University has developed the AI "DeepGI" for detecting abnormal polyps in the colon, and it has been tested on patients since 2021. In the area of treatment pathways and support, Chulabhorn Hospital has piloted the use of the AI "Watson for Oncology" for oncology treatment planning since 2020.

Literature indicates that several policy issues could affect the adoption of AI in public healthcare. Regarding government regulation, AI adoption may be impeded if a robust regulatory framework ensuring privacy, security, quality, and accuracy is lacking (Haider, 2020). Conversely, excessive regulation may lead to high financial commitments and organizational inertia due to stringent limitations on AI applications (Hamm & Klesel, 2021). The availability of various resources within the ecosystem also impacts the adoption. For example, countries may encounter challenges with the availability of quality datasets, hindering AI model development and implementation in the health sector (Gujral et al., 2019; Haider, 2020). A lack of financial resources can also be a barrier, as seen in studies on AI adoption by the National Health Service in the United Kingdom (Morrison, 2021). Governments play a crucial role in shaping AI adoption strategies for various reasons, such as reducing health inequalities between social classes, saving healthcare costs by improving early diagnosis and promoting better prevention through self-health management (Ossewaarde & Gulenc, 2020).

To fully leverage the potential of AI in the healthcare sector, it is necessary to understand the policy issues associated with promoting widespread adoption. To analyze the policy challenges in the ecosystem of medical AI, the study will use a framework of the technological innovation system (TIS) as a guideline for analysis. This framework has advantages in explaining the emergence, growth, and dissemination of technology within a community (Bergek et al., 2008; Hekkert et al., 2007). Such advantages are owing to the system functions, one component of the TIS framework, which illustrate the dynamic innovation supporting activities within the system. Such features are not seen in other innovation ecosystem frameworks such as the national innovation system or sectoral system of innovation (Köhler et al., 2016). System functions refer to contributions made by structural components, static parts of a TIS, to achieve goals of development, diffusion, and utilization of technological innovation in the system (Sawulski et al., 2019). The analysis of TIS functions can help researchers identify the drivers and barriers within a system as well as holistically evaluate the ecosystem performance in promoting a particular technological innovation (Edsand, 2019; Sawulski et al., 2019). The results can ultimately benefit policy formulation in this area. Different TIS functions are shown in Table 1.

Table 1 TIS functions and descriptions (Bergek, 2019; Bergek et al., 2008; Hekkert et al., 2007) summarized by the authors

TIS Functions	Descriptions
1. Knowledge development and absorption	The knowledge base of TIS, its breadth and depth, and its evolution over time, covering technology and innovation management knowledge, scientific knowledge, and technology capability.
2. Knowledge diffusion	Exchange or transfer of information, knowledge, and technology among different entities in networks
3. Formation of market	Opening up of a space or arena for the exchange of goods and services among suppliers and buyers in a semi-structured manner.
4. Legitimation of innovations	Process of achieving legitimacy of the new technology among relevant stakeholders.
5. Mobilization of resources	Process for acquiring different types of resources required for innovation to occur.
6. Entrepreneurial experimentation	Process for reducing uncertainty about the prospect of new technologies through trial-and-error experimentation with new technologies, applications, and strategies.
7. Guidance and direction of the search	The process leading to the formation of priorities for the technology that actors should adopt.

The objective of this study is to investigate policy issues in leveraging the potential of AI in public hospitals in Thailand. The main research question is "what are policy issues for promoting the adoption of AI innovations in public hospitals in Thailand?" The primary author adapted the TIS functions to align with the issues related to the adoption of AI innovation. First, the author introduced the function "dissemination of innovations". Although other functions can analyze activities that indirectly impact innovation diffusion, they do not concern the mechanisms driving AI innovations from suppliers to widespread use. Second, the function "knowledge development and absorption" was removed since issues related to this function are already embedded in other functions, particularly the mobilization of resources as well as entrepreneurial experimentation. Moreover, the function "knowledge diffusion" was also dropped and incorporated into the proposed "dissemination of innovations" function, as it concerns the exchange or transfer of information about existing innovations among different entities in networks. This study proposed the modified TIS functions as follows: (1) dissemination of innovations, (2) formation of market, (3) legitimation of innovations, (4) mobilization of resources, (5) entrepreneurial experimentation, and (6) guidance and direction of the search.

Methodology

This study employed a qualitative research method. This approach is appropriate for investigating research questions that are exploratory and for identifying variables that are difficult to measure within a group or population. Additionally, a qualitative research method offers advantages in understanding complex and detailed issues. Moreover, a qualitative research aids the author in understanding the contexts or environments in which the study participants engage with a problem or issue (Creswell, 2013).

Participants

This study utilizes data from a database of in-depth interviews, which is part of the doctoral dissertation titled "The Adoption of Artificial Intelligence Innovations in Thai Public Hospitals: Multiple Case Studies." The database contains records of interviews with 52 key informants, 36 of whom reported policy issues at an ecosystem level. The key informants, shown in Table 2, include representatives from government agencies, higher education institutions, public hospitals, and a medical-AI service provider involved in policy support, development, or implementation of healthcare-related AI innovations. In this database, public hospitals are those that have adopted AI-based image processing technology for lesion screening of patients. Compared with other types of AI, image-processing AI, especially chest X-ray image analysis AI, is among the most widely adopted by the healthcare sector in Thailand.

Table 2 A summary of key informants and code names

Affiliations	Positions of key informants	Number	Code names
Government agencies			GA 1–10
Office of National Higher Education Science Research and Innovation Policy Council	Middle management leaders	2	
Department of Medical Services	Senior management leader	1	
Food and Drug Administration	Officers	2	
Digital Economy Promotion Agency	Senior management leader	1	
National Electronics and Computer Technology Center (NECTEC)	Director	1	
Program Management Unit for Human Resources & Institutional Development, Research and Innovation (PMU-B)	Senior management leader	1	
	Officer	1	
Program Management Unit for Competitiveness (PMU-C)	Expert	1	
Higher education institutions	Engineering/data science professors	6	HE 1–6
University-partnered/ affiliated hospitals	Head, of department/ former head of center of excellence	2	UH 1–6
	Gastroenterologists	2	
	Radiologists	2	

Table 2 Continued

Affiliations	Positions of key informants	Number	Code names
Ministry of Public Health (MoPH)-affiliated hospitals			MPH 1–11
A specialized cancer hospital	Hospital directors	2	
	A senior management leader	1	
A standard-level hospital	A senior management leader	1	
	An IT officer	1	
An advance-level hospital	A senior management leader	1	
	A nephrologist	1	
	A radiologist	1	
Community-level hospitals	Hospital directors	2	
	An IT officer	1	
An AI service provider	A chief executive officer	1	ASP 1–3
	A chief operating officer	1	
	A co-founder	1	
Total		36	

Data Collection

The data collection for this database was conducted by the primary author using semi-structured questions from February to July 2023. The primary author employed purposive sampling (Tashakkori et al., 2020) to identify relevant key informants and snowball sampling (Tashakkori et al., 2020) to collect data from additional informants based on recommendations from previous informants. Open questions were asked to interviewees about the process of AI adoption (where relevant) as well as the drivers and barriers to adoption. Each interview lasted 30–120 minutes, depending on the interviewees' roles in the healthcare-AI ecosystem. Interviews were audio or video recorded with the interviewees' permission and then transcribed orthographically into written words.

Data Analysis

The primary author conducted thematic analysis on the transcribed materials. Thematic analysis is used by scholars to systematically identify, organize, and provide insight into patterns of meaning across a collected dataset. It can be applied to studies with a large number of interviewees (Braun & Clarke, 2012; Clarke et al., 2015). The primary author then sought a theme related to policy issues at an ecosystem level concerning the promotion of AI innovation adoption. The analysis was assisted by ATLAS.ti 23 software. The result of the analysis is a synthesis of insights provided by the software and the author's judgment.

Ethics

Ethical approval for this study was obtained from the Ethics Committee in Human Research, National Institute of Development Administration [Reference Number: COA No. 2023/0004].

Results and Discussion

The data analysis reveals that the ecosystem of AI-based medical innovation in Thailand faces various policy issues as follows.

Dissemination of Innovations

The process of disseminating medical-based AI innovations in Thailand faces several challenges. First, there is the issue of benefit sharing arising from joint research and development projects in AI (*GA3, GA7, MPH2*). This arises due to the involvement of multiple entities, requiring multidisciplinary collaborations among different organizations.

> *"Once the (AI) innovation generates income, it would cause an issue. If benefit sharing is not fair, it would cause limitation to widespread implementation. . . . We need to negotiate on benefit sharing. Otherwise, the public health system would not benefit from the innovation and the cost of implementing would remain high."*
>
> (MPH2, personal communication, March 31, 2023)

This becomes particularly crucial if hospital data are utilized for developing commercial AI technology (*GA1, GA10*). Research universities often have clear

mechanisms to manage innovations resulting from multidisciplinary collaborations, such as technology accelerators and incubators.

Secondly, there is a lack of sustainable business models, particularly for AI systems developed from university research projects (*HE6*). Such issues arise partly because the development of some medical AI technologies is driven by university researchers rather than market demand (*GA8*, *UH4)*. A business model could be a system integrator which plays a crucial role in scaling up and disseminating AI prototypes developed by researchers for subsequent widespread adoption (*GA10*). This process requires a substantial budget and effort to maintain the system's functionality at a high quality (*HE6*).

> *"Many (AI) projects have benefits and high impact for the country, but they cannot proceed because there is no funding to sustain the system. Medical AI systems require a lot of resources. For example, (the name of chest X-ray AI system) needs to be run on a GPU, which costs hundreds of thousands (baht). If we do not have any money, where will we get it from? Also the salary for someone to monitor the system 24/7, where will that come from too? This has been a problem we have been facing all along."*
>
> (HE6, personal communication, April 7, 2023)

Thirdly, a clear mechanism for scaling up AI adoption in state-owned hospitals at a reasonable cost remains elusive. Researchers and developers typically rely on their networks to disseminate developed AI applications (*UH5*), necessitating intermediary organizations to facilitate scaling-up efforts. Likewise, hospitals that adopted AI innovations indicated that their awareness about the existence of AI innovation and subsequent adoption decisions were driven by existing networks. These networks include informal relationships with other hospitals *(MPH4)* or the Thai Health Tech Association *(MPH6)*, existing relationships with IT service suppliers *(MPH9)*, or academic collaborations with an innovator hospital *(MPH10)*. The DMS is developing a sustainable model for scaling up AI innovation in public hospitals (*GA3*). Regional or Provincial Health Offices could potentially facilitate dissemination by negotiating optimal prices with developers, leveraging their responsibility for supporting health service agencies (*MPH2*). Budget support from the MoPH to these offices is crucial for widespread AI adoption in public hospitals.

Formation of Market

Market formation involves creating a space for goods and services exchange between suppliers and buyers in a semi-structured manner (Bergek, 2019). In this study, it was found that government procurement serves as a tool to stimulate the AI technology market. The Thailand Innovation List, introduced in 2015, incentivizes state agencies to procure goods or services from listed vendors through special procedures, aiming to promote innovative products and services by Thai entrepreneurs (The Secretariat of the Cabinet, 2015). While a medical AI product has been added to the Innovation List (*ASP3*), options remain limited. Medical AI devices must be registered with the Thai Food and Drug Administration (FDA) for inclusion to the List, but FDA registration is seen as costly and cumbersome (*GA7, MPH1, MPH5*). Slow FDA certification is attributed to a shortage of technical experts in AI medical software (*GA3, GA4, GA5*). Businesses may expedite certification by registering products in major markets before seeking Thai FDA approval (*GA5, GA10, ASP1*). Financial constraints hinder compliance with FDA standards for non-commercial AI devices developed by researchers in universities or public hospitals (*MPH1, MPH5*). Additionally, hospital users may not recognize the need for FDA certification for AI software (*MPH4, MPH7, MPH9*).

> *"Regarding the FDA registration, I really view the AI as a disease screening gadget so I did not consider that it had to be registered with FDA. Moreover, it is neither a medicine nor medical product. It is also too new to have a qualification (for registration). Additionally, if it does not affect the workflow of patient treatment, doctors may not have concern (of using it)."*
>
> (MPH7, personal communication, May 9, 2023)

Despite lacking FDA approval, some hospitals adopted AI technology (such as like AI chest X-ray technology), because of its benefits. Clarity on whether AI medical applications need FDA certification was deemed "ambiguous" (*MPH5, ASP1*). This ambiguity likely results from inadequate information dissemination by the FDA to the public (*GA4*).

Legitimation of Innovations

Legitimation in the context of TIS is the process of achieving legitimacy of the new technology among relevant stakeholders. This includes adaptation or

conformity to existing institutions, alteration of existing institutions or the creation of entirely new institutions (Bergek, 2019). Acceptance of new technology by relevant actors is crucial for gaining political support (Bergek et al., 2008). The study found varying opinions on AI displacing healthcare professionals. Fears of displacement could be a barrier for initiating R&D projects in medical AI, especially when forming a research team (*MPH5*).

> *"In terms of acceptance, back then, radiologists were against it. I invited many people to join (the AI research project). . . . They were afraid of losing their career. If this (AI chest X-ray) software comes in, will it take their jobs? Will it reduce their value?"*
>
> (MPH5, personal communication, April 19, 2023)

However, there has been growing debate among healthcare professionals about the AI benefits. For instance, the Radiological Society of Thailand organized the First Thailand Conference on AI in Medical Imaging in 2021. The Royal College of Radiologists of Thailand released guidelines for leveraging the benefits of AI in radiological practices during 2021–2023. These include procurement and utilization guidelines and a standard operating procedures for AI testing in tuberculosis screening.

The study highlights the ongoing process of regulative legitimation (Bergek, 2019) of AI-related cross-sectoral issues within existing legal frameworks. Currently in Thailand, there is no specific law governing activities related to research, design, development, utilization, and transfer of AI-related technologies. These activities are still subject to overarching legal frameworks that govern the security of personal data such as the Personal Data Protection Act (PDPA) B.E. 2562 (discussed later) and the Cybersecurity Act B.E. 2562. Ethical oversight for research related to AI is managed by the ethics committee in human research, under the National Ethics Committee Accreditation System of Thailand (NECAST) (National Research Council of Thailand [NRCT], 2018). This system oversees all disciplines of research that involve human subjects. This committee operates at various levels, including the ministry level, the department level, the provincial level, the hospital level, and the faculty level within universities. Given that the unstandardized practice of personal health data management for research purposes remains, the ethics committees within the respective organization must independently determine the appropriate usage of such data for research. Hospitals within medical schools often justify data usage for AI research to improve the hospital services quality. However, it remains unclear whether such actions are permissible *(GA7)*. Inappropriate practices in human research ethics certification at the ministry level, including overstepping authority, unreasonable document requests, and miscommunication between committees and research teams, were reported (*MPH1, MPH5*).

Mobilization of Resources

Data

Recently, various government agencies have invested in digital infrastructure to support AI research and development. In 2019, the National Science and Technology Development Agency (NSTDA) launched the NSTDA Supercomputer Center or ThaiSC, featuring ASEAN's most powerful supercomputer, "LANTA," to support cost-effective AI research. The Ministry of Digital Economy and Society (D.E.) also introduced the G-Cloud to enhance data sharing and AI development across government agencies. To further strengthen health data infrastructure, the DMS plans to invest in a cloud server for deploying AI algorithms in nationwide medical services. This will support major AI and big data projects, like Genomics Thailand, and serve as a repository for Thai-owned data *(GA3)*.

The health data ecosystem in Thailand faces ongoing challenges in managing personal health data, including generation, sharing, and utilization. The Personal Data Protection Act (PDPA) represents Thailand's primary legislation on personal data protection, providing guidelines for collecting, using, and disclosing such data. While the PDPA lacks specific provisions for data utilized by AI systems, it serves as a framework for managing data crucial for AI training. However, enforcement of the PDPA poses challenges for AI development. Firstly, hospitals, as data owners, express concerns about data security, leading to hesitancy in releasing personal health data to researchers (*GA1, GA8*). This reluctance complicates data-sharing among hospitals and different research partners, hindering collaboration in medical AI research (*HE4, UH1*). Moreover, normally, the sharing of data among different entities requires protocols such as approval from the respective ethics committee in human research. While this is necessary, the process further slows down external validation in the development of AI and the overall AI development process.

"We had concern on patients' personal data sharing. It would be easier to manage patients' data from a hospital within the (same) university. . . . We attempted to discuss (collaboration) with other university, but we found difficulty in data sharing."

(UH1, personal communication, April 8, 2023)

Secondly, there is ambiguity in defining personal information, particularly regarding non-identifiable, anonymized data such as X-ray images (*GA7, ASP3*). Decisions on the appropriateness of using these types of data for R&D project are entirely subject to the ethics committee in human research within each respective organization (*ASP3*).

"When the PDPA came into effect, we had to study it. However, for lung X-ray data that we do not know to whom such belongs and having no identity, it's unclear . . . This issue is a bit ambiguous, and many organizations are discussing what to do with it. Every research project in the country nowadays refers to ethical guidelines. But the PDPA does not clearly state what is allowed or not."

(ASP3, personal communication, March 9, 2023)

Thirdly, there is a limited availability of public health data necessary for AI model development (*GA8*, *ASP3*). Some types of data are in short supply such as those from three-dimensional magnetic resonance imaging (3D-MRI) since they are not generated from conventional health check-up services (*HE4*). In contrast, open-source data from other countries may have limited quality since they may not be prepared purposively for a specific AI R&D project. Nevertheless, the preparation of data to become suitable for AI training is technically complex, time-consuming, and requires a group of high-level experts to work together (*HE6, ASP3*). In healthcare-related AI, these experts are medical professionals who are pre-occupied with existing medical service workload and may not be available for an AI development project (*UH3, UH4*).

Financial resources

Following Thailand's 2019 reform of the science, research, and innovation system, public R&D funding agencies have taken on more strategic roles in promoting innovation. There has been a clearer division of labor among R&D funding agencies, utilizing the technological readiness level (TRL) as a framework for such divisions *(GA8)*. Funding agencies have also introduced financing schemes to foster collaborative innovation and accelerate entry to the market *(GA8, GA10)*. For example, the Program Management Unit for Competitiveness (PMU-C) requires matching research funds with the private sector to ensure commercial technology transfer and, also, provides supports for medical AI prototypes in obtaining FDA certification *(UH1)*. In 2023, overall public spending in R&D and innovation projects related to AI (in all fields) was 7,355 million baht, increasing by 15 percent from 6,411 million baht in 2022 (National Science and Technology Development Agency, 2023).

Despite the novel funding system being in place, interviewees reported issues related to financial support both in the R&D process and in the implementation of AI technologies in hospitals. Regarding the R&D process, delayed, or inadequate public R&D financial support from government funding agencies was reported. Interviewees also reported a significant amount of advance payment for equipment necessary for the development project (*HE6, UH3*). Approval for research funding is naturally a lengthy process. Without the advance payment, the testing and external validation of AI applications would be impossible. Moreover, inadequate financial support in the very early, risky stage of development discourages the researchers from joining the AI R&D project. Instead, the financial support came at a less risky stage when the AI prototype had been developed successfully (*UH3*). The lack of budgetary allocation for R&D corresponds with the limited R&D investment in Thailand compared to other countries. In 2021, the country's R&D expenditure was 195,570-million-baht, equivalent to 1.2 percent of the country's GDP, compared with other developed nations, such as South Korea (4.9%), Japan (3.3%), and Singapore (2.2%). Public sector investment in R&D constitutes 26 percent of total R&D expenses (NRCT, 2023).

In terms of implementation, hospitals reported a deficiency in financial support from the MoPH (*MPH6, MPH9, MPH10*). Budget allocation or technological support does not align with the country's vision to promote digital technology adoption in public hospitals, despite policies like smart hospital initiatives and S-curve industries policies covering medical hubs and digital technology (*MPH1, MPH6, MPH9*).

"MoPH hardly supports us. The budget is scarce. Budget cuts always happen. The hospital must find a way by ourselves if we think the technology is important. The MoPH hardly offers these (technologies) to us. A software that is used nationwide does not exist."

(MPH9, personal communication, May 29, 2023)

Additionally at a bigger picture, funding for implementing the Thailand National AI Strategy and Action Plan (2022–2027) has not been automatically allocated, despite cabinet endorsement, necessitating case-by-case funding applications to various agencies (*GA7*). Limited AI adoption demand may stem from state hospitals' technological readiness issues, lacking fundamental IT infrastructure (*GA10, MPH4*).

Own hospital revenues serve as a potential financial source to support the implementation. However, small community hospitals often have insufficient income to spend on the adoption of costly AI technology, unless they receive financial support from external resources through special projects (*MPH3, MPH4, MPH10*).

> *"Other hospitals saw (the chest X-ray AI) and also wanted to subscribe, but they lacked budgeting. However, in future, if the financial support becomes halted, we are not sure if we could continue the subscription."*
>
> (MPH10, personal communication, June 13, 2023)

Human resources

Shortage of skilled manpower for the development of AI model impeded the AI development project. The shortage is significant for researchers in computer science, computer engineering, or data science and AI engineers or data engineers that have to be responsible for the deployment of digital technology in the medical field, where stringent standards for technology deployment for patient care is necessary. A shortage of skilled digital professionals with hands-on experience in the industries has created an obstacle to direct investment from international technology companies that plan to invest in cloud infrastructure in the country (*GA10*). Besides, there is a shortage of domain experts involved in the development process of AI algorithms and data labeling (*GA8*, *GA10, HE3, UH4*). In the development of medical AI applications, these domain experts are specialized physicians who are frequently occupied with patient care responsibilities (*GA10*).

> *"The problem is that we did not have manpower. Despite the funding we had. . . . that funding could have been spent on hiring someone (to label data). But we could not hire anyone. Those who would take this job must have knowledge. We need to hire doctors to do this, but they are already overwhelmed with work."*
>
> (UH4, personal communication, February 10, 2023)

The reported shortage is consistent with the findings of the Government AI Readiness Index 2023, which indicates that Thailand's human capital index scores are among the lowest compared to other areas. The shortage of personnel will have repercussions on other TIS activities, including the development of a data ecosystem (due to a lack of personnel for data labeling) and trial-and-error experimentation.

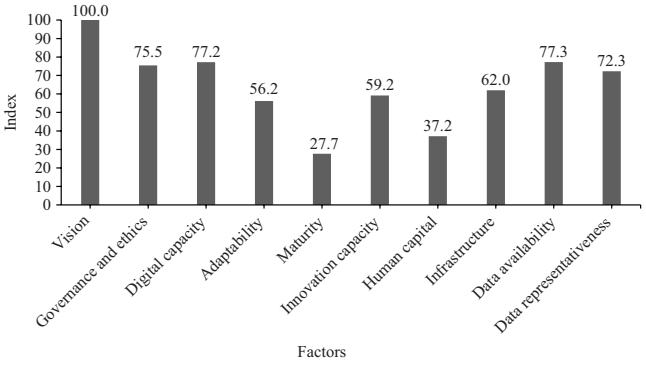

Figure 1 Thailand's Government AI Readiness Index 2023.
Source: Oxford Insights (2023). Summarized by the authors.

Entrepreneurial Experimentation

Various organizations engage in trial-and-error experimentation with new AI medical technologies, applications, and strategies to reduce uncertainty. The DMS directly mitigates the uncertainty associated with the adoption of novel medical technologies. In one way, the DMS serves as a hub to support the development of a management model and technical knowledge of disease treatment. These models are then transferred to hospitals under the MoPH, which serve as test sites of the new models and technologies (*GA3, MPH2*). Both the DMS and the Thai FDA have the authority to initiate "sandboxes" to generate insights into management practices related to the adoption of new medical technologies where clear laws or regulations are absent. However, there is currently no instance of applying this sandbox framework for any real-world case study (*GA3*).

Universities possess the potential to serve as a fertile ground for the advancement of excellent medical AI innovation. Recently, there have been changes in the roles and expectations of higher education institutions in fostering innovation development. In February 2015, the Cabinet announced that research and innovation in collaboration with industries are part of the responsibilities of university professors under the Talent Mobility policy.

In 2021, the Ministry of Higher Education, Science, Research and Innovation (MHESI) announced that innovation development can be recognized as an indicator for academic position promotion (Committee of Civil Service in Higher Education Institutions, 2021). However, in practice, recognizing innovation work as part of the performance evaluation of faculty members still faces challenges in translating the policy into implementation. These challenges include the absence of standardized performance metrics (*UH1, UH5, UH6*) and a lack of recognition of the impact of the innovation work on the performance evaluation (*HE5*). These challenges are particularly pronounced in the faculty of medicine, where innovation development is not prioritized compared to teaching, research, and patient care services.

> *"We cannot really count the time spent on these tasks (development of AI application) as academic service. I think it is because they do not know how to measure it. It's just a small part of the department that receives this funding (and takes part in this project). When it comes to counting the work, there has to be an agreement on what tasks can be counted, except when this work is published as a research paper. . . . Even though the (AI) technology that we have developed is actually being used, there's no clear measurement or plan for measurement because not everyone is doing this."*
>
> (UH5, personal communication, May 29, 2023)

Guidance and Direction of the Search.

In addition to the National AI Strategy and Action Plan (2022–2027), the government and other state agencies have announced policies aimed at promoting the adoption of digital technologies to enhance public health in the country. For example, the government envisioned the country to become a prominent healthcare destination in Asia, a "medical hub" to attract international patients and medical tourists. Additionally, in 2018, the government introduced "smart hospital" policies to improve the quality of healthcare services by leveraging advanced technologies for analysis, diagnosis, and care planning (Pongtriang et al., 2023). Despite these policy directions, hospitals rarely reported the influence of government policy on their decisions to adopt AI innovations. One key informant explicitly reported the disconnection between the hospitals' decision to adopt AI applications and the country's AI technology strategy or MoPH policy.

> *"At the time we decided to implement it (the chest X-ray AI technology), the ministry's policies or regulations had no influence on our decision to adopt it."*
>
> (MPH8, personal communication, April 27, 2023)

Instead, the desire for adoption is more dependent on perceived resource availability for development, such as X-ray images for AI model training, and on specific users' pain points, such as the shortage of radiologists and the negative impact of the COVID-19 outbreak on the healthcare workers' workload *(UH1, MPH1, MPH9).*

Conclusion and Recommendation

This study, utilizing the TIS framework, investigates policy issues in AI adoption in Thai public health. The study found that the lack of consensus on benefit-sharing models in AI project partnerships and the absence of scalable business models could hinder widespread dissemination. Government procurement efforts are limited by a narrow range of products on the Innovation List, while high costs and a cumbersome FDA approval process further impede AI market entry. Although AI legitimation mechanisms exist, they lack operational clarity, such as clear justifications for using health data and processes for obtaining ethical approval in AI research. Resource deficiencies and inefficient allocation affect both the development and implementation of health-related AI technologies. Despite a supportive policy framework for developing and testing medical AI innovations, practical implementation is limited, and national policies may have yet to significantly influence hospitals' AI adoption decisions.

This study contributes to a better understanding of the impact of activities within the TIS on the adoption of AI in public health. It shows TIS activities could potentially influence innovation suppliers, users, and the mechanisms connecting the suppliers to broader user bases. The study provides insights for policymakers in designing better support for promoting the development and adoption of AI innovations in public health. Drawing from the findings, the MoPH should increase funding to regional health offices to facilitate the adoption of digital applications in public hospitals. The MHESI and the MoPH should jointly establish a structured framework for partnership management to facilitate multidisciplinary collaboration in innovation development.

The Board of Investment (BOI) and the Ministry of Industry should promote the growth of system integrator firms to result in AI service with sustainable business model. The FDA should streamline the process of certifying AI medical devices and focus on clear communication with developers and users regarding the legal requirements for registering medical AI-based equipment. Additionally, ethics approval for AI-related medical research should be streamlined to balance innovation with regulatory oversight.

Furthermore, government or medical professional associations should continue to organize public advocacy programs to promote understanding of medical AI. Experience of digital transformation in early adopter hospitals should also be shared among later adopter groups. Early adopters can trigger and stimulate the spreading of information or opinions about the experience of adopting innovation. This would lead to imitative behavior by the later adopters (Frattini et al., 2014).

This study encountered certain limitations. Firstly, the interviewees who are developers and adopters are limited to those involved with GI endoscopy and chest X-ray image AI. Compared with other types of AI, image-processing AI especially chest X-ray image analysis AI is among the most widely adopted by the healthcare sector in Thailand (Prasarnphanich, 2022). Other AI systems and/or areas of applications may exhibit different challenges to adoption (Petersson et al., 2022). Secondly, this study did not aim to explore comprehensive issues in the medical AI ecosystem but rather focused solely on issues that impact adoption. Therefore, it has not yet identified issues related to knowledge development and policy guidance.

Future research should explore the views of adopters utilizing other types of AI systems to enhance the generalizability of the study. Additionally, future investigations may specifically focus on studying policy issues related to the development of medical AI innovation, which is another goal of TIS function.

Conflict of Interest

The authors declares that there is no conflict of interest.

Acknowledgments

The authors would like to express our gratitude to all participants of this research.

References

Bergek, A. (2019). Technological innovation systems: A review of recent findings and suggestions for future research. In F. Boons & A. McMeekin (Eds.), *Handbook of sustainable innovation* (pp. 200–218). Edward Elgar. http://dx.doi.org/10.4337/9781788112574.00019

Bergek, A., Jacobsson, S., Carlsson, B., Lindmark, S., & Rickne, A. (2008). Analyzing the functional dynamics of technological innovation systems: A scheme of analysis. *Research policy*, *37*(3), 407–429. https://doi.org/10.1016/j.respol.2007.12.003

Braun, V., & Clarke, V. (2012). Thematic analysis. In H. Cooper, P. M. Camic, D. L. Long, A. T. Panter, D. Rindskopf, & K. J. Sher (Eds.), *APA handbook of research methods in psychology, Vol 2: Research designs: Quantitative, qualitative, neuropsychological, and biological.* (pp. 57–71). American Psychological Association. https://doi.org/10.1037/13620-004

Clarke, V., Braun, V., & Hayfield, N. (2015). Thematic analysis. In J. Smith (Ed.), *Qualitative psychology: A practical guide to research methods* (pp. 222–248). Sage Publications.

Committee of Civil Service in Higher Education Institutions. (2021). *ประกาศ ก.พ.อ. เรื่อง หลักเกณฑ์และวิธีการพิจารณาแต่งตั้งบุคคลให้ดำรงตำแหน่งผู้ช่วยศาสตราจารย์ รองศาสตราจารย์ และศาสตราจารย์ พ.ศ.2564* [Announcement of the committee of civil service in higher education institutions regarding criteria and procedures for the appointment of assistant professors, associate professors, and professors B.E.2564]. https://basd.mhesi.go.th/Files/Announcement/ประกาศ ก.พ.อ. ตำแหน่งทางวิชาการ 2564.pdf [in Thai]

Creswell, J. W. (2013). *Qualitative inquiry and research design: Choosing among five approaches* (3rd ed.). SAGE Publications.

Edsand, H. E. (2019). Technological innovation system and the wider context: A framework for developing countries. *Technology in society*, *58*, 101150. https://doi.org/10.1016/j.techsoc.2019.101150

Frattini, F., Bianchi, M., De Massis, A., & Sikimic, U. (2014). The role of early adopters in the diffusion of new products: Differences between platform and nonplatform innovations. *Journal of Product Innovation Management*, *31*(3), 466–488. https://doi.org/10.1111/jpim.12108

Gujral, G., Shivarama, J., & Mariappan, M. (2019). Artificial intelligence (AI) and data science for developing intelligent health informatics systems. *Proceedings of the Ntional Conference on AI in HI & VR, SHSS-TISS* (pp. 30–31). Mumbai, India.

Haider, H. (2020). *Barriers to the adoption of Artificial Intelligence in healthcare in India*. https://opendocs.ids.ac.uk/articles/report/Barriers_to_the_Adoption_of_Artificial_Intelligence_in_Healthcare_in_India/26434654?file=48084319

Hamm, P., & Klesel, M. (2021). *Success factors for the adoption of Artificial Intelligence in organizations: A literature review*. Annual 27th Americas Conference on Information Systems, AMCIS. Montreal. https://aisel.aisnet.org/cgi/viewcontent.cgi?article=1257&context=amcis2021

Hekkert, M. P., Suurs, R. A., Negro, S. O., Kuhlmann, S., & Smits, R. E. H. M. (2007). Functions of innovation systems: A new approach for analysing technological change. *Technological Forecasting and Social Change*, *74*(4), 413–432. https://doi.org/10.1016/j.techfore.2006.03.002

Köhler, J., Braungardt, S., Hettesheimer, T., Lerch, C., Nabitz, L., Sartorius, C., & Walz, R. (2016). *The dynamic simulation of TIS functions in transitions pathways*. (Discussion Paper No. 48). Fraunhofer ISI. https://www.econstor.eu/bitstream/10419/128499/1/847845621.pdf

Ministry of Higher Education, Science, Research and Innovation, & Ministry of Digital Economy and Society. (2022). *แผนปฏิบัติการด้านปัญญาประดิษฐ์แห่งชาติเพื่อการพัฒนาประเทศไทย (พ.ศ. 2565–2570)* [Thailand national ai strategy and action plan (2022–2027)]. https://pub.nstda.or.th/gov-dx/wp-content/uploads/2022/12/20220726-AI.pdf [in Thai]

Morrison, K. (2021). Artificial intelligence and the NHS: a qualitative exploration of the factors influencing adoption. *Future Healthcare Journal*, *8*(3), e648-e654. https://doi.org/10.7861/fhj.2020-0258

National Research Council of Thailand. (2018). *ประกาศสำนักงานคณะกรรมการวิจัยแห่งชาติ เรื่อง ระบบการรับรองคุณภาพคณะกรรมการจริยธรรมการวิจัยในมนุษย์* [NRCT Announcement on National Ethics Committee Accreditation System of Thailand: NECAST]. http://www.msdbangkok.go.th/bkkresearch/filePDF/policy/2/1.7.pdf [in Thai]

National Research Council of Thailand. (2023). *ดัชนีวิทยาศาสตร์ วิจัยและนวัตกรรม บันไดสู่การพัฒนาประเทศ 2566* [Science, research, and innovation index: A Pathway to national development 2023]. https://nrct.go.th/file/report-nrct/2566-handout.pdf [in Thai]

Office of the National Economic and Social Development Council (2023). *The thirteenth national economic and social development plan (2023–2027)*. https://www.nesdc.go.th/wordpress/wp-content/uploads/2025/02/article_file_20230615134223.pdf

National Science and Technology Development Agency . (2023). *Thailand national AI strategy 2022–2027 annual report 2023*. https://ai.in.th/wp-content/uploads/2024/06/AI-Thailand-Annual-Report-2023.pdf

Ossewaarde, M., & Gulenc, E. (2020). National varieties of artificial intelligence discourses: Myth, Utopianism, and solutionism in West European policy expectations. *Computer*, *53*(11), 53–61. https://doi.org/10.1109/MC.2020.2992290

Oxford Insights. (2023). *Government AI readiness index 2023*. https://oxfordinsights.com/ai-readiness/ai-readiness-index/

Petersson, L., Larsson, I., Nygren, J. M., Nilsen, P., Neher, M., Reed, J. E., Tyskbo, D., & Svedberg, P. (2022). Challenges to implementing artificial intelligence in healthcare: A qualitative interview study with healthcare leaders in Sweden. *BMC health services research*, *22*(1), 1–16. https://doi.org/10.1186/s12913-022-08215-8

Pongtriang, P., Rakhab, A., Bian, J., Guo, Y., & Maitree, K. (2023). Challenges in adopting artificial intelligence to improve healthcare systems and outcomes in Thailand. *Healthcare Informatics Research*, *29*(3), 280–282. https://doi.org/https://doi.org/10.4258/hir.2023.29.3.280

Prasarnphanich, P. M. (2022). *Thailand's digital entrepreneurship digital health and wellness*. https://www.adb.org/sites/default/files/institutional-document/826606/adou2022bp-thailand-digital-entrepreneurship-health.pdf

Sawulski, J., Gałczyński, M., & Zajdler, R. (2019). Technological innovation system analysis in a follower country — the case of offshore wind in Poland. *Environmental Innovation and Societal Transitions*, *33*, 249–267. https://doi.org/10.1016/j.eist.2019.07.002

Singweratham, N., Decha, N., Waichompu, N., Somnak, S., Tamepattanapongsa, A., Thongrod, S., & Runlert, C. (2021). ความขาดแคลน ความต้องการ และแนวโน้มกำลังคนด้านรังสีการแพทย์ในระดับสถานพยาบาล ของสำนักงานปลัดกระทรวงสาธารณสุข กระทรวงสาธารณสุข [Shortage and demand of radiologic technologists for health care settings under the jurisdiction of the office of the permanent secretary, ministry of public health]. *The Southern College Network Journal of Nursing and Public Health*, *8*(1), 115–126. https://he01.tci-thaijo.org/index.php/scnet/article/view/240047/167772 [in Thai]

Siripanumas, C., Suphanchaimat, R., Nittayasoot, N., & Sawaengdee, K. (2022). Distribution of physicians to public health facilities and factors contributing to new medical graduates serving in public facilities, 2016–2020, Thailand. *Risk Management and Healthcare Policy*, *15*, 1975–1985. https://doi.org/10.2147/RMHP.S384507

Tangjai, C. (2020). *ปัจจัยที่มีผลต่อการยอมรับในการเข้ามาของปัญญาประดิษฐ์ในด้านรังสีวิทยาของสถาบันด้านการให้บริการทางการแพทย์ของไทย* [Factors that affect the barrier to entry of radiology AI in Thai medical services institutes] [Master's dissertation, Mahidol University]. https://archive.cm.mahidol.ac.th/bitstream/123456789/3691/1/TP%20MS.035%202563.pdf [in Thai]

Tantibundhit, C., Ekgasit, S., & Kanchanaranya, N. (2020). *ระบบคัดกรองผู้ป่วยโรคเบาหวานขึ้นจอตาและผู้ป่วยโรคจอประสาทตาเสื่อมอย่างอัตโนมัติ* [Automated screening system for diabetic retinopathy and age-related macular degeneration patients]. Thammasat University. https://kb.hsri.or.th/dspace/handle/11228/5218?locale-attribute=th [in Thai]

Tashakkori, A., Johnson, R. B., & Teddlie, C. (2020). *Foundations of mixed methods research: Integrating quantitative and qualitative approaches in the social and behavioral sciences* (2nd ed.). Sage publications.

Thailand Development Research Institute. (2018). *รายงานการศึกษา เรื่อง: ประมาณการค่าใช้จ่ายสาธารณะด้านสุขภาพในอีก 15 ปีข้างหน้า* [Study report: Estimation of public healthcare expenditure for the next 15 years]. https://tdri.or.th/wp-content/uploads/2019/12/ประมาณการค่าใช้จ่ายสาธารณะด้านสุขภาพในอีก-15-ปีข้างหน้า.pdf [in Thai]

The Secretariat of the Cabinet. (2015). *การให้สิทธิพิเศษแก่ผลิตภัณฑ์และบริการนวัตกรรมที่อยู่ในบัญชีนวัตกรรมไทย* [Granting of special privileges to innovative products and services listed in the Thai innovation list]. https://www.nstda.or.th/innovation/wp-content/uploads/2023/01/มติ-ครม-6พย58-ให้สิทธิพิเศษสินค้าบัญชี.pdf [in Thai]