

SWOT-TOWS analysis of an electronic health referral system: basis for development strategy

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ABSTRACT

Along with the implementing rules and regulations of Republic Act No. 11223 (Universal Health Care Act) and the national mandate for the digital transformation of basic services, the Philippine health sector faces the imperative to implement an interoperable electronic referral (eReferral) system. This study applies strengths, weaknesses, opportunities, threats (SWOT) and threats, opportunities, weaknesses, strengths (TOWS) to conduct a SWOT-TOWS strategic analysis of internal and external factors affecting the existing healthcare referral system and to generate evidence-based strategies for national eReferral system adoption. The analysis identifies strong policy support and institutional frameworks as key enablers, while fragmented information and communication technology (ICT) infrastructure, absence of Health Level Seven International (HL7)/Fast Healthcare Interoperability Resources (FHIR) interoperability standards, limited bandwidth in rural facilities, and insufficient technical personnel constitute primary barriers. Comparative benchmarking against the UK NHS eReferral service and US EHR-based referral systems highlights critical design gaps in the Philippine context. The proposed strategies, encompassing a centralized system architecture, ICT readiness investments, and compliance with ISO/IEC 27799 health informatics security standards, provide an actionable framework for policymakers, ICT planners, and healthcare administrators. This study contributes to health informatics literature by applying strategic analysis to health IT system design as a novel methodological intersection.

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1. INTRODUCTION

The Philippine Constitution of 1987 protects the people's right to basic health care. According to section 11 of Article XIII, the state must support accessible healthcare and adopt an integrated and comprehensive approach to health development [1]. Under the direction of the Department of Health (DOH), national government organizations and local units are in charge of carrying out the execution of health programs, reforms, and services.

The Philippines' healthcare system can be considered at par with its neighboring countries' high-quality services. This is mainly due to the close collaboration of the government-owned corporation

Philippine Health Insurance Corporation and other allied sectors. The country's health system has undergone and implemented several rounds of reforms [2]. The most significant was the Republic Act No. 11223, the Universal Health Care Act, signed into law in February 2019 [3]. The law mandates the institutionalization of health technology assessment as a fair and transparent priority-setting mechanism for developing policies and programs about health services.

Despite the constitutional mandate supporting the health sector, difficulties persist due to poor implementation of the hospital information management system. Only a few DOH Level 3 hospitals and major private-sector hospitals have modern facilities for maintaining patient records. Even private clinics do not have such. Thus, record-taking management and patient referral processes are quite tedious. Many would like to take advantage of technologies enabled by the digital revolution, believing that information and communication technology (ICT) may transform the delivery of healthcare services. Such technologies are essential for supporting healthcare-related activities, such as profiling, identifying health risks, and determining needs. The ICT system provides several applications to support duties in clinical care, medical research, and administrative issues [4]. It facilitates access to all data types and generates effective healthcare services. One of the demands for such technologies during these times is the electronic health (e-Health) system, which communicates referrals between primary care providers and specialists in in-patient and out-patient settings [5].

The World Health Organization (WHO) defines referral as a “dynamic process” through which a health professional at one level of the health system contacts a higher level with greater resources or expertise to seek support or transfer patient management [6]. Effective referral systems are critical to ensuring timely access to specialized healthcare services and improving patient outcomes. However, referral processes continue to experience communication delays, record management errors, and coordination challenges that may prolong patient waiting times and compromise the quality of care [7]. Although electronic referral (eReferral) systems have been recognized as a means of improving healthcare coordination, few studies have examined the strategic and organizational factors that affect their implementation in Philippine healthcare settings. Therefore, it is necessary to analyze the current referral system.

This study aims to determine the current state of health referral systems in public and private hospitals in Central Luzon. It intends to investigate the existing referral processes from the district, provincial, city, and community hospitals down to municipal health offices, rural health units, birthing facilities, and private hospitals and clinics. To better understand the components that are controllable and uncontrollable, this study uses the strengths, weaknesses, opportunities, threats (SWOT) analysis technique developed by Albert Humphrey in 1960. It extends the process into threats, opportunities, weaknesses, strengths (TOWS) matrix analysis, developed by Weihrich in 1982 [8]. The resulting strategic framework is intended to support the development and implementation of an e-Health referral system and provide guidance for improving healthcare service delivery.

2. RELATED WORKS

Electronic health records (EHRs) and hospital information systems (HIS) are widely used to improve the management, storage, and exchange of patient information. These systems support healthcare delivery by enhancing care quality, improving operational efficiency, reducing costs, and facilitating research and public health surveillance [9]. However, challenges related to interoperability, cybersecurity, and data privacy remain significant concerns in healthcare information systems [10].

The increasing demand for healthcare services has accelerated the adoption of digital health technologies, including eReferral systems. Health referral systems facilitate the transfer of patients and clinical information between healthcare providers, helping ensure continuity of care and timely access to specialized services [11]. Despite technological advances, implementing eReferral systems continues to face challenges, including fragmented information systems, limited interoperability, inadequate ICT infrastructure, and concerns about data security [12]. These issues highlight the need for strategic approaches to support the effective implementation of e-Health referral systems.

2.1. Electronic referral systems

According to Alonso *et al.* [13], eReferral systems have been designed to reduce waiting times and improve workflow efficiency. By streamlining the referral process, these systems significantly enhance the quality of patient services [14]. Patient referral is a critical component of healthcare delivery [11], ensuring that patients are treated at the most appropriate time.

Previous studies have examined the role of e-Health referral systems in improving healthcare delivery and referral processes [5], [13]. Findings indicate that eReferral systems enhance communication, workflow efficiency, and patient information management [11], [13]. However, coordination problems and

process-related issues continue to persist due to organizational and implementation challenges [15]. Furthermore, most studies have focused primarily on system implementation and technical adoption [4], with limited attention given to organizational readiness and strategic factors influencing eReferral adoption.

While existing studies have demonstrated the benefits of eReferral systems in improving communication, workflow efficiency, and patient information management [11], [13], most have focused on system development, technical implementation, and operational outcomes. Comparatively fewer studies have examined the strategic, organizational, and environmental factors that influence the successful adoption and sustainability of eReferral systems, particularly in developing-country healthcare settings. This limitation indicates the need for a broader assessment of the conditions that support effective eReferral implementation and long-term integration within healthcare organizations.

2.2. Electronic health records and digital health

For effective use of EHR systems, health professionals, the primary users, must be familiarized with and trained to use them. These systems facilitate better management of health records, which contain medical history, diagnoses, medications, and test results. Studies have shown that digital health technology can help improve health literacy and is becoming a core component of healthcare delivery [16]. Compromising the integrity of patient data could be fatal and lead to incorrect diagnoses and treatment decisions. Although the transition to EHR systems may increase documentation workloads, studies have shown that they improve efficiency and patient care outcomes, particularly in emergency healthcare settings [17]. With adequate training and organizational support, the full potential of EHR systems can be realized.

2.3. Challenges in referral systems

Bossyns *et al.* [18] identified the referral process as one of the weakest links in healthcare organizations. Effective healthcare delivery requires coordination among providers to ensure accurate diagnosis, appropriate treatment, and seamless patient transfers across care levels. Without an effective referral mechanism, patients may experience delays and difficulties in navigating the healthcare system [2].

In many healthcare settings, patient referrals continue to rely on paper-based documents, handwritten referral slips, fax transmissions, emails, and other manual processes. These approaches often result in fragmented information exchange and limited accessibility of patient records among healthcare providers. Furthermore, primary care providers and specialists frequently operate on separate information systems, limiting interoperability and efficient access to patient information [5]. Although EHRs facilitate referral management and information sharing, communication errors and unsatisfactory referrals may still occur because of technical and organizational challenges [5], [15].

2.4. Research gap

Previous studies have demonstrated the benefits of eReferral systems, EHRs, and digital health technologies in improving healthcare delivery [11], communication, workflow efficiency, and patient information management [5]. However, most existing research has focused primarily on system development, technical implementation, and operational outcomes [4], [15]. Limited attention has been given to the strategic, organizational, and environmental factors that influence the successful adoption and sustainability of eReferral systems, particularly in developing-country healthcare settings. Furthermore, there is a lack of studies examining the readiness and implementation challenges of eReferral systems across interconnected public and private healthcare facilities in Central Luzon.

Despite government initiatives such as the Universal Health Care Act and the continuing modernization of healthcare services [9], challenges remain in achieving effective coordination and information exchange among healthcare institutions. The coexistence of public and private healthcare providers further increases the complexity of establishing interoperable referral systems across healthcare facilities [19], [20]. To address these gaps, this study applies SWOT and TOWS analyses to evaluate internal and external factors affecting the implementation of an eReferral system and to develop strategic recommendations to support its adoption in the Philippine healthcare context.

3. METHOD

This section describes the research design, data sources, article selection process, and analytical procedures used in this study, ensuring that the methods are transparent, valid, and reproducible. The methodology explains how the research questions identified in the Introduction were addressed and how the SWOT–TOWS analytical framework was applied to develop strategic recommendations for the e-Health referral system. To thoroughly discuss how e-Health referral works in an integrated healthcare system. Several research studies and related literature relevant to these systems were meticulously evaluated and

analyzed to acquire the necessary data before building the new method/strategy. This literature review served as the basis for identifying internal and external factors affecting the e-Health referral system and provided the foundation for the SWOT-TOWS analysis. It served as a guiding concept in conducting the theoretical study and as a significant step toward creating successful organizational processes.

3.1. Research design

This study used a descriptive and strategic analysis research design to examine the current e-Health referral system and to develop strategic recommendations using SWOT and TOWS analytical tools. The descriptive approach was used to analyze the current state of the referral system based on existing literature, policies, and reports, while the strategic analysis approach was used to formulate strategies to improve the e-Health referral system. The descriptive design was appropriate because it enabled a systematic evaluation of the existing referral environment, including its processes, challenges, and supporting policies. Data obtained from literature, government documents, healthcare reports, and information system standards were analyzed to identify factors affecting referral system implementation. These factors were treated as strengths, weaknesses, opportunities, and threats using the SWOT framework. The resulting SWOT factors were integrated into the TOWS matrix to generate strategic alternatives and recommendations for enhancing the implementation and adoption of e-Health referral systems.

3.2. Article selection

The articles, reports, and memoranda that were utilized as materials came from manual searches as well as public domain resources such as Google and Google Scholar, ResearchGate, and Academia.edu, as well as high-impact journals and electronic databases like PubMed and Medline, Scopus, and Web of Science. The inclusion criteria included unrelated studies, duplicate articles, and studies without full text. It also contains journals relevant to the topic, as identified and shown in Figure 1, and the records of the article selection process using the preferred reporting items for systematic reviews and meta-analyses (PRISMA). The PRISMA flow diagram was used to ensure a systematic and transparent selection of related literature.

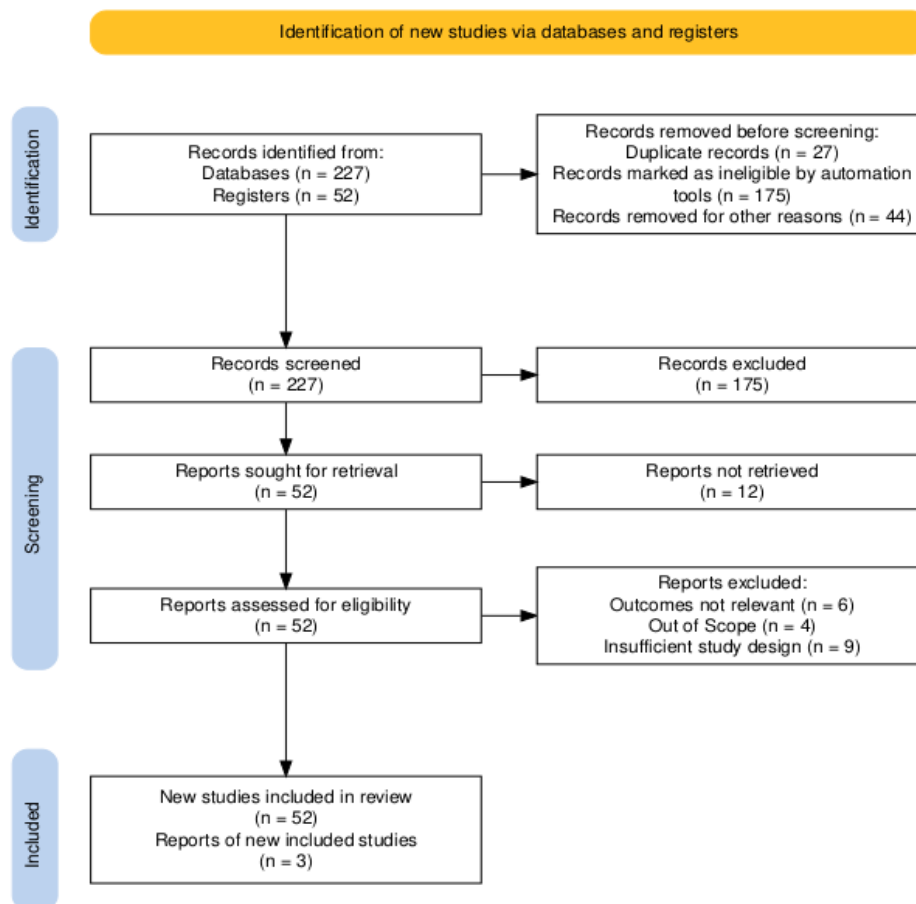


Figure 1. Article selection flow diagram

3.3. Information and communication technology infrastructure assessment framework

To address the technical dimensions of the SWOT analysis, this study incorporated an ICT infrastructure readiness assessment framework adapted from the WHO Digital Health Atlas indicators and the Department of Information and Communication Technology (DICT) national connectivity benchmarks. The following parameters were evaluated qualitatively against available national data. Bandwidth adequacy, as indicated by DICT reports, indicates that approximately 70% of Philippine facilities have internet access, with rural areas frequently operating below the 10 Mbps threshold required for stable EHR transactions [12], [21]. As for Server capacity and data center infrastructure, only DOH Level 3 hospitals maintain dedicated server infrastructure; lower-level facilities lack local server capacity, necessitating cloud-hosted architecture [19]. For cybersecurity resilience, the National Privacy Commission (NPC) has documented recurring incidents of unauthorized access to HIS, reflecting insufficient endpoint security and the absence of unified security protocols [10], [20]. The interoperability of heterogeneous hospital management system (HMS) platforms across public and private hospitals, with no mandated adoption of Health Level Seven International (HL7)/Fast Healthcare Interoperability Resources (FHIR) messaging standards, creates systemic interoperability barriers [9], [22]–[24].

3.4. International benchmarking

To contextualize Philippine-specific findings, this study benchmarks against two established national eReferral systems. The National Health Service (NHS) eReferral service in the United Kingdom and EHR-based referral systems in the United States were selected because they represent mature implementations of eReferral systems with established interoperability, governance, and security frameworks. The best practices and implementation approaches adopted by these systems provide valuable insights that may guide the development and adoption of eReferral systems in the Philippine healthcare sector. Table 1 presents a comparative benchmarking analysis of the NHS, US EHR-based referral systems, and the Philippine healthcare context, highlighting differences in interoperability, policy support, infrastructure readiness, and referral system governance.

Table 1. Comparative benchmarking of eReferral systems: NHS (UK), US EHR-based referrals, and the Philippine context

Dimension	NHS eReferral (UK)	US EHR-based referral	Philippines (current)
System	Centralized national platform	Federated EHR networks (Epic, Cerner) via FHIR APIs	Fragmented; facility-level HMS; no national platform
Architecture	(NHS Spine)	HL7 FHIR R4 (mandated by 21st Century Cures Act) [25]	No mandated standard; heterogeneous vendors [28]
Interoperability	HL7 v3/NHS MESH	HIPAA Security Rule; NIST Cybersecurity Framework	NPC Data Privacy Act (RA 10173); no sector-specific standard
Security	ISO/IEC 27001; NHS DSP	Hundreds of millions of referral transactions via EHR [25]	Primarily paper-based; eReferral are limited to Level 3 hospitals
Framework	toolkit	Legislative mandate	Awaiting e-Health systems Act (HB 10245); no financial incentive mechanism
Referral	>15 million referrals/year	(MACRA/MIPS); financial incentives for EHR adoption [25]	
Volume/scale	nationally [26]		
Key success	Mandatory national adoption;		
Factor	standardized GP registration [26]		

3.5. SWOT-TOWS analytical framework

The study employed two prominent strategic analysis tools, namely the SWOT analysis and TOWS matrix [8], [27]. SWOT analysis is widely used in strategic planning and risk assessment [26], while the TOWS matrix analysis is a tool for situational analysis that matches environmental threats and opportunities with the company's weaknesses and strengths to formulate strategic actions [8]. In this study, a SWOT analysis was used to identify internal (strengths and weaknesses) and external (opportunities and threats) factors affecting the implementation of the e-Health referral system. The identified factors were derived from literature review, government policies, health system documents, and ICT strategic plans. The TOWS matrix was applied to develop strategic alternatives strength–opportunity (SO), weakness–opportunity (WO), strength–threat (ST), and weakness–threat (WT) strategies, which served as the basis for the proposed strategic framework.

The SWOT-TOWS framework is a systematic assessment [27] used by many in the business sector as a critical decision-making tool. While SWOT separately identifies organizational and environmental factors independently, TOWS focuses on the strategic interaction in developing responsive strategies. The generated strategies were evaluated based on engineering feasibility, implementation priority, and alignment with international standards (HL7/FHIR [25], ISO/IEC 27799 [28], and IEEE 11073 [29]).

To improve methodological rigor, quantitative indicators were incorporated into the analysis. An ICT infrastructure readiness score (IIRS) was conceptualized using DICT connectivity data, DOH hospital

classification, and cybersecurity assessments [10], measured across bandwidth, security, interoperability, and ICT human capital dimensions. A referral efficiency index (REI) was also conceptualized to measure the ratio of completed eReferral to total referrals, benchmarked against the NHS (>95%) [25] and US EHR environments (>80%) [30], emphasizing the low rate of eReferral adoption in Philippine primary healthcare settings.

3.6. Strengths, weaknesses, opportunities, threats analysis

The SWOT analysis is a widely used technique for systematically evaluating organizations, encompassing internal and external factors [8], [31]–[34]. It is a key decision-making tool that originates in business management [27]. SWOT analysis is the most effective technique to recognize strengths, weaknesses, opportunities, and threats critical to attaining goals. This technique will assist in identifying areas that are performing well and those that are underperforming [32]. Additionally, this method enables the prediction of future trends or the applicability of a particular approach. Dahliah *et al.* [31] reiterate that the most effective approach to balancing an organization's internal and external factors is maximizing strengths and opportunities while minimizing weaknesses and threats. These two factors are essential for developing effective strategies that capitalize on opportunities, mitigate weaknesses, and counter threats while maximizing strengths.

Figure 2 illustrates how the SWOT analysis works. The internals are the entities that could influence the organizational and financial resources, infrastructures, and procedures. These are just examples of internal strengths that may lead the organization in the right direction. While external weaknesses are the inverse of internal strengths. Certain factors within the agency's control, such as technology, economics, politics, and competition, will lead to poor company direction if not properly planned and managed. Organizations may develop an early warning system using SWOT analysis to evaluate all essential precautionary measures before possible risks arise [26]. SWOT analysis is also helpful in determining the best business strategies for an organization to implement. This strategy identifies and links organizational strengths and weaknesses and opportunities to benefit from the external environment, to mitigate negative consequences.

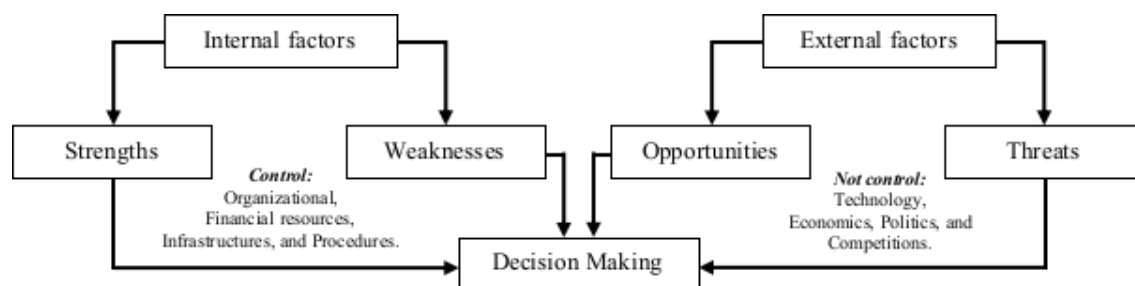


Figure 2. SWOT analysis

3.7. Threats, opportunities, weaknesses, strengths analysis

The TOWS matrix analysis is employed to further illustrate the strengths and opportunities, and the threats and weaknesses, to determine the best strategy for an e-Health referral system. Weihrich's [8], the TOWS matrix provides a conceptual framework for analyzing the interaction between internal and external factors within an organization. Once those key factors are identified, the TOWS matrix becomes a useful and effective instrument for strategic planning [35] since it necessitates managers to analyze situations and devise strategies, tactics, and actions to effectively and efficiently achieve goals and missions [8]. Furthermore, the TOWS matrix can be seen as a framework for assessing, formulating, comparing, and finally deciding upon ideas and business strategies [36].

The TOWS concept begins with auditing external threats and opportunities. These are the uncontrollable actions outside the organization's perimeter. Furthermore, TOWS encourages organizations to analyze their surroundings to improve their operations comprehensively. Building a big basket of opportunities and firewalls against threats is advantageous for an organization, and TOWS excels in reducing threats [34]. TOWS has a broad scope. It also looks at internal environmental factors, which are classified as the strengths and weaknesses of the organization [37]. The strengths are advantageous in meeting the target market's needs, while the weaknesses are the limitations that give the company a perspective on what it cannot see.

Figure 3 illustrates how TOWS works. In the assessment phase, TOWS identifies the strengths, weaknesses, opportunities, and threats (displayed in column 1 and row 1 of Figure 3). It also includes a preparation audit of strengths and weaknesses that focuses on the internal and external environments [8]. In the internal environment, combining strengths and weaknesses can lead to opportunities for developing more strategies, tactics, and specific plans to reach the organization's ultimate goals. Strengths-opportunities concentrate on prioritizing and aligning business process-wide operations and exploiting the available resources. In terms of weaknesses, top officials can make better decisions and provide better services if they use opportunities to improve internal environments. Incorporating this process is a big help in alleviating factors that will impact the operation by developing a strengths-threats contingency strategy. This strategy outlines precise countermeasures to external threats that cause uncontrollable issues, mitigating the negative effects. The objective is to mitigate these issues by aligning strengths and weaknesses with threats, preventing the organization from being in a precarious position, and fostering ongoing development and improvement.

	Strengths	Weaknesses
	<i>this field list the internal strengths</i> 1.	<i>this field list the internal weaknesses</i> 1.
Opportunities	SO - Strengths and Opportunities Strategy	WO - Weaknesses and Opportunities Strategy
<i>this field, list the external Opportunities</i> 1.	<i>this field, list the SO Strategy</i> 1.	<i>this field, list the WO Strategy</i> 1.
Threats	ST - Strengths and Threats Strategy	WT - Weaknesses and Threats Strategy
<i>this field, list the external Threats</i> 1.	<i>this field, list the ST Strategy</i> 1.	<i>this field, list the WT Strategy</i> 1.

Figure 3. TOWS matrix developed by Weihrich [8]

4. RESULTS AND DISCUSSION

This study examined the current e-Health referral system using SWOT-TOWS analysis to develop strategic recommendations. While previous studies investigated EHRs and eReferral systems, they focused mainly on system development and implementation and did not explicitly address strategic planning, organizational readiness, or environmental factors affecting their implementation in developing countries. This study addresses these gaps by analyzing internal and external factors affecting the e-Health referral system and by developing strategic recommendations using the SWOT-TOWS framework.

The SWOT analysis identified several strengths, including government support, existing healthcare policies, and ICT initiatives in the health sector. However, weaknesses such as limited ICT infrastructure, lack of standardization, fragmented systems, and insufficient technical personnel were also identified. Opportunities include government digital transformation programs, partnerships with ICT agencies, and the availability of open-source technologies, while threats include cybersecurity risks, interoperability issues, and unequal access to ICT infrastructure.

These findings are consistent with previous studies, which found that eReferral systems improve communication, coordination, and efficiency in healthcare delivery but require strong organizational support, infrastructure, and standardization to be successfully implemented [5], [11], [13], [15]. According to the WHO, health referrals are critical in assisting and enhancing patient care [6]. This work identified the positive and negative issues concerning the Philippines' e-Health referral systems from all levels of DOH and private hospitals and clinics through a thorough investigation. As illustrated in Table 2 (see Appendix), the competitive internal environment of the country's healthcare system consists of processes, policies, goals, and objectives [36]. The table also presents information on the defense against those uncontrollable external threats and the best preparation strategies.

4.1. Strength-opportunity strategies

4.1.1. Enact a law that standardizes the eHealth referral system among public and private hospitals (S1, S2, S3, S6, S7, O1, O2, O3, O4, O7, O8)

The passing of the Universal Health Care Act of 2019 was a significant move by the government to address the country's long-standing health issues [9]. The universal health care law ensures that all will be

given quality healthcare services [3] alongside the institutionalized digital health system, which aims to transform the new service delivery into the fastest, most accurate, and safest healthcare possible. Furthermore, the universal health care law aims to boost the information system, which includes the centralization of disease monitoring and an integrated human health resource database. However, the law has not taken into account the readiness of all hospitals for an e-Health referral system. Many things must be considered when adopting these new technologies and processes. A needs assessment must be conducted to determine the current standing regarding facilities, the readiness of institutions and human resources, and the ongoing enactment of laws by our lawmakers to improve the health system in the country. Recently, the House of Representatives passed on third reading House Bill N. 10245, the “e-Health Systems and Services Act”, which provides a holistic approach to establishing the national e-Health system. This law allows for the standardization of policies in the delivery of e-Health services at national and local agencies. As shown in Figure 4, the proposed interagency coordination for the e-Health referral system was based on existing hospital coordination for transporting and admitting patients between healthcare facilities.



Figure 4. Proposed interagency coordination of the eHealth referral system

All hospitals, whether government-controlled or private hospitals or clinics, must have a standard system. A proposed inter-agency coordination of the e-Health referral system is illustrated in Figure 3. The DOH, PhilHealth, and other allied agencies may work together so that this type of universal referral, the process of referring patients to other facilities, ranging from district, provincial, city, and community hospitals to municipal, rural, and birthing facilities, and vice versa, will speed up, thus streamlining the process, improving service delivery, and saving more lives. The call of the President for the digitalization of basic services, alongside the increasing rise of multispecialty centers in different regions, coincides with the pursuit of this referral system. Universal health care may call for an EHR in hospitals, but it does not standardize the eReferral. Thus, implementing this strategy will be vital for universal health care's adherence.

4.1.2. Standardize HL7/FHIR as the National eReferral Interoperability Protocol (S1, O1)

The interoperability gap between facility-level HMS platforms constitutes the most critical engineering barrier to national eReferral implementation. Unlike the NHS, which mandated HL7 v3 compliance as a prerequisite for NHS Spine integration [25], or the US regulatory environment enforcing FHIR R4 APIs through the 21st Century Cures Act [30], the Philippines currently has no mandated interoperability standard for health information exchange [9], [22]. Jiménez *et al.* [38] demonstrate that HL7 FHIR, OpenEHR, and ISO 13606 possess distinct yet complementary capabilities, and that FHIR is most appropriate for real-time data exchange—precisely the function required for an eReferral platform.

The proposed strategy calls for the DOH, in coordination with DICT and PhilHealth, to designate HL7 FHIR R4 as the required data exchange standard for all HMS platforms seeking PhilHealth accreditation renewal. This regulatory lever—already established through S3 (PhilHealth accreditation enforcement)—provides a cost-effective mechanism for driving vendor compliance without direct procurement. Implementation should include a phased transition timeline: Level 3 hospitals within 18 months; Level 2 within 36 months; Level 1 and primary care within 60 months. Supporting this mandate, the DOH should publish Philippine Implementation Guides for FHIR-based referral resources (patient, encounter, ServiceRequest, task) aligned with international profiles such as the International Patient Summary (IPS) standard.

4.1.3. Appropriation of bigger funds for developing ICT projects focused on health care delivery (S4, S5, S7, S8, O8, O10)

In 2005, the DOH issued standard policies, procedures, and guidelines governing all ICT-related work [2], directing the DOH hospitals to revisit and go through an evaluation process to ensure compliance with the ICT standardization that envisions having one data source that will strengthen the integration and harmonization of all existing health-related information systems through establishing the Knowledge Management And Information Technology Service (KMITS). Currently, it has a multi-access health

information system that causes a lengthy process for entering patient data; institutionalizing a single health information management system would reduce duplication of patient records. In the 1980s, Executive Order No. 119 was issued to develop the ICT infrastructure used by the agency in decision-making. They aimed to help universal health care by enhancing the ICT program to guarantee effectiveness, efficiency, and quality of healthcare services. As a result of the EO, funds were allocated to the health sector. Year after year, the DOH budget appropriation increased incrementally, as shown in Table 3. It is evidence that the government is committed to creating a healthier population and a successful healthcare system in the country [39], [40]. The DOH budget allocation supports ICT development initiatives and the implementation of health information systems in government hospitals [40]. However, only 12% of the budget belongs to the health facilities enhancement program, which generally covers the procurement of infrastructure and medical equipment, not to mention ICT development. To improve services, health officials must propose lone ICT funds to achieve the KMITS mission of improving health care delivery through the use of ICT infrastructure and applications.

Table 3. DOH CY 2010 onwards budget appropriation

Year	Personal services	MOOE	Capital outlay	Total
2025	86,783,224,000	110,871,768,000	25,553,981,000	223,188,973,000
2024	83,879,826,000	96,144,731,000	24,574,438,000	204,598,995,000
2023	78,520,240,000	93,565,561,000	23,991,753,000	196,077,554,000
2020	41,537,121,000	37,691,135,000	8,804,327,000	88,032,683,000
2019	42,835,960,000	37,996,847,000	16,820,826,000	97,653,633,000
2018	33,898,293,000	40,897,030,000	31,286,773,000	106,082,096,000
2017	27,980,471,000	39,738,421,000	27,555,183,000	95,274,075,000
2016	21,012,441,000	74,077,638,000	27,540,074,000	112,630,153,000
2015	10,510,714,000	62,837,166,000	13,620,817,000	86,968,697,000
2014	10,768,046,000	58,749,635,000	14,203,240,000	83,720,921,000
2013	8,866,448,000	30,489,783,000	11,086,068,000	50,442,299,000
2012	7,633,148,000	25,994,815,000	8,528,000,000	42,155,963,000
2011	7,709,552,000	15,192,127,000	8,926,937,000	31,828,616,000
2010	6,866,566,000	11,316,923,000	6,466,276,000	24,649,765,000

Source: DOH Budget [39], [40]

The data presented indicate that allocations for developing ICT projects in hospitals remain relatively low, as healthcare service delivery expenditures are often prioritized over digital infrastructure investments. Thus, it is imperative that standard budgetary allocations for ICT development align with the provisions of the Universal Health Care Act [3], which promotes the use of health information systems. Adequate investment in ICT infrastructure is essential to support the implementation of interoperable e-Health systems and improve healthcare service delivery. Insufficient funding may delay the modernization of healthcare information systems, limit interoperability among healthcare institutions, and hinder the adoption of eReferral systems. Therefore, healthcare officials should develop evidence-based budget proposals and lobby legislators during the budget authorization process to secure increased funding for digital health initiatives through the annual General Appropriations Act (GAA) [3], [40]. Sustained investment in digital health infrastructure will strengthen healthcare coordination, enhance information exchange, and contribute to the long-term sustainability and effectiveness of eReferral systems in the Philippine healthcare sector.

4.1.4. Develop a centralized electronic health referral system for all hospitals in the Philippines (S5, S7, S8, S9, O3, O4, O8, O10)

Quality health services are essential for the realization of universal health care. Investing in state-of-the-art facilities, particularly the hospital management information system to record patients' information and health cases, must be available to frontline health workers. Unfortunately, most health facilities still use the traditional paper-based method of recording patient Information and making referrals to other facilities or health providers; only those hospitals operated by large corporations and DOH hospitals classified as Level 3 have that kind of HMS. Furthermore, because of multiple HMS runs with different facilities, repeated inputting of patients' Information into the database occurs frequently. According to Alonso *et al.* [13], designing an automated standard for Information and communication within the referral process will improve wait times and the quality of referrals efficiently. A unified eReferral system will speed up healthcare delivery. With these changes, they will have immediate access to the entire patient record [15], which is beneficial to both health workers and patients because it results in clarity of information, knowing what tasks are being completed, and a better understanding of the patient's condition, resulting in immediate medication and treatment.

As stated in the universal health care law, interoperable systems must consistently upload and log health records following the DOH standards [9]. In 2013, developing a research agenda for the health sector and implementing ICT in healthcare services began [41]. This was the start of mapping and digging into the outcomes of universal health care, and then on April 15, 2014, an e-Health Strategic Framework and Plan for 2014–2020 was released with the vision to guide the national coordination and collaboration in establishing the DOH data warehouse and responsive information system [41]. Prior to this development, Table 4 shows the joint administrative orders for institutionalizing the adoption and implementation of universal health care through ICT programs that tap different stakeholders and expert agencies to partner and collaborate in building e-Health plans. It also demonstrates that the government's orders were simply a gradual move to institutionalize and invest in an e-Health system, connecting government data centers, and databases to create a secure network for the government information system [19] to collect data for decision-making.

Table 4. Joint administrative orders

AO number	Agency	Title	Objectives
Joint Department Memorandum Order 2013-0200	DOH and Department of Science and Technology (DOST)	Creation of Joint DOH-DOST National Governance Steering Committee and Technical Working Group on eHealth	Formulation of a research agenda on the use of ICT in health. Composition of a working committee group to plan for eHealth initiatives, programs, and projects.
Joint Administrative Order 2016-0001	DOH, DOST, and PhilHealth	Implementation of the Philippine Health Information Exchange	Institutionalize the adoption and implementation of the Philippine Health Information Exchange
Joint Administrative Order 2016-0003	DOH and PhilHealth	Adoption of the Philippine Health Information Exchange Lite	Institutionalize the implementation of a standardized procedure for developing an application for health information systems.
Joint Administrative Order 2017-0001	DOH, PhilHealth, DOST, and DICT	Implementation of the National eHealth EHR System Validation	Define the policies and guidelines, and the roles, duties, and responsibilities of the concerned agencies, to successfully implement the National eHealth EHR System Validation.

Source: DOH website [41]

4.2. Weaknesses-opportunities strategies

4.2.1. Strengthening the IT service with new plantilla positions (W6, W9, O5, O7)

The development of the DOH data warehouse and information systems is contingent upon the contributions of the ICT personnel. Key individuals are responsible for developing and maintaining health systems. Despite implementing ICT services, the government still must do a lot to improve how healthcare is delivered, especially regarding ICT's involvement [20]. In the Department of Budget and Management's index of occupational services, groups, classes, and salary grades [39], [40], ICT staffed members held positions ranging from one to three in the government job classification system, these included technology officers, computer file librarians, computer maintenance technologists, computer programmers, information system researchers and analysts, and computer programmers. The DICT has a manpower shortage to oversee the projects enumerated in the DOHs Information System Strategic Plan 2018-2020 [19]. The proposed plantilla positions released by DBM last December 2022 only included 11 IT personnel for hospitals with up to 1000 beds. Considering the growing demand for IT services, DBM and DICT should work together with the help of the House of Representatives to approve more significant funds for the plantilla position of ICT developer with a high salary rate to level up with the private ICT companies and attract them to work in the government. This will give a big push to attaining the dream of better ICT infrastructure in health facilities and systems.

4.2.2. In partnership and with a joint Department Memorandum, DOH-DOST-DICT should put in the priority projects the development of the National E-Referral System. (W1, W6, W7, W9, O5, O7, O8)

The DOH Information System Strategic Plan 2018–2020 [41] lays out all information system projects in every health section, requiring numerous ICT developers to maintain and manage the e-Health projects. In response to these difficulties, the DOH and the concerned organizations published a “National E-Health Information Interoperability Standards Change Management Manual”. [42], which contains the standards for operational and management guidelines for establishing, adopting, implementing, and overseeing all e-Health transactions across local and national health information systems and applications. The national e-Health steering committee, the technical working group, the collaborative team comprising various stakeholders, and groups and teams led by experts in health data standards are depicted in Figure 5. These groups will oversee and set direction for the nation's ongoing development and improvement of e-Health projects, particularly the e-Health referral system.

4.2.3. Involvement of private hospital ICT developers and tie-up with local universities and colleges to develop a national eHealth System. (W1, W5, W6, W7, W8 O7, O38, O9)

The Universal Health Care Act, RA11223 Section 31, urges the DOH and PhilHealth to coordinate with the partner agencies, the DICT, and the NPC, regarding the submission of health-related data to the National Health Data Repository [3]. In addition, to strengthen health policy and systems research, the DOH asked local government units to establish frameworks to support the formation of research consortia. DOST's engagement in offering academic research, systems researchers, and technological professionals to examine pertinent curricula that align with our health demands. Since there is only a limited number of IT personnel in hospitals, private hospital ICT developers, as well as skilled people in local universities and colleges, including faculty and students, can be tapped to work with government personnel to develop national e-Health systems. This will increase the pool of talent that can be tapped for such developmental activity.

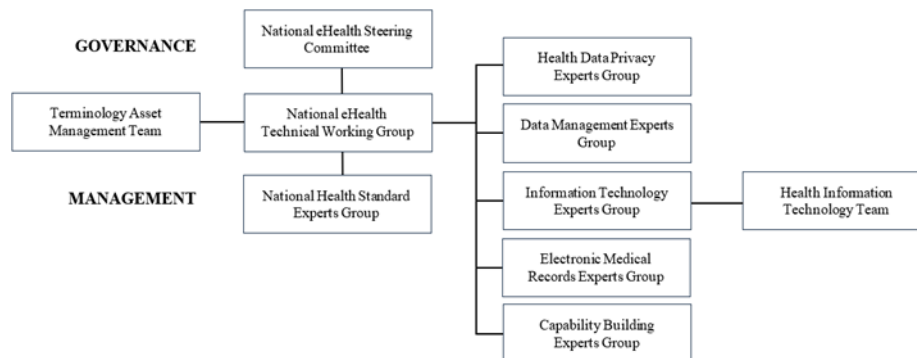


Figure 5. Governance and management structure of the National Health Data Standards

4.3. Strengths-threats strategies

4.3.1. Nationwide upskilling and competency standards of healthcare IT professionals compliant with global standards (S8, S9, T3)

To develop a pool of health specialists, policymakers, system researchers, technical experts, and administrators of health systems, the DOH provides and oversees funding for training grants [3], [39]. With the help of DOST, we shall identify and look for a benchmark academic and training institution to fortify the ICT skills of healthcare professionals. provided, as stated in universal health care law Section 31.5, that those chosen will provide a return of service, in compliance with compensation and additional incentives.

4.3.2. DICT and DOST will provide the needed secure technologies and will set the standards that will host referral and EHR (S4, S3)

Developing the necessary system for eReferral will require skilled personnel and secure technologies, including both hardware and software components. In addition, appropriate standards must be established to ensure interoperability, security, and consistency across healthcare institutions. DICT and DOST may work together to spearhead the procurement of these technologies and develop the necessary standards in coordination with other government agencies, educational institutions, and private organizations. Furthermore, DICT can provide technical leadership in establishing interoperability and cybersecurity frameworks that support the secure exchange of health information. DOST can contribute through research and innovation initiatives that promote the development and adoption of emerging digital health technologies. The collaboration of these agencies will help ensure that eReferral systems are scalable, secure, and aligned with national digital transformation goals, thereby enhancing healthcare coordination and service delivery.

4.4. Weaknesses-strengths strategies

4.4.1. Establishing the infrastructure for a DOH data center (W1, W6, W7, W8, W9, T1, T2, T8, T9)

The most cutting-edge facilities and tools are needed for technology to function optimally. The purchase of ICT infrastructure for the DOH data center will increase productivity in health service development, project monitoring and management, and support. According to Esquivel *et al.* [5], to ensure that information is always available to physicians and patients upon request, eReferral communication must be thorough and executed in a non-intrusive manner. Everyone must commit and be on board with creating strategic planning for it to succeed. To stay current, health specialists, system researchers, technical experts, and health systems managers should research and track industry developments as well as provide the

necessary infrastructure to host such data centers. Synthesizing the results of the SWOT-TOWS analysis, the proposed strategic framework for Philippine national eReferral adoption comprises four interdependent pillars that address policy, technology, organizational, and human resource requirements. The framework is designed to support the nationwide implementation of a secure, interoperable, and sustainable eReferral system aligned with the national digital health priorities. Each pillar contains strategic actions and engineering requirements that collectively address the identified strengths, weaknesses, opportunities, and threats affecting eReferral adoption.

4.4.2. Investing in infrastructure for network facilities (W3, W6, W8, W9, T4, T7)

The network infrastructure in the Philippines is lagging compared to our neighboring countries. DICT stated that only seventy percent of the population has internet access, and thirty percent still have no access [12], [21]. The infrastructure across all areas that will use it should also be improved so that a national referral system can work. Thus, bigger investments should be allocated to such.

5. PROPOSED STRATEGIC FRAMEWORK FOR NATIONAL EREFERRAL ADOPTION

Synthesizing the results of the SWOT-TOWS analysis, the proposed strategic framework for Philippine national eReferral adoption comprises four interdependent pillars that address policy, technology, organizational, and human resource requirements. The framework is designed to support the nationwide implementation of a secure, interoperable, and sustainable eReferral system aligned with the national digital health priorities. Each pillar contains strategic actions and engineering requirements that collectively address the identified strengths, weaknesses, opportunities, and threats affecting eReferral adoption. Table 5 summarizes the proposed framework and its corresponding implementation components.

Table 5. Strategic framework pillars for the adoption of the Philippine national eReferral system

No	Pillar	Key actions and engineering requirements
1.	Policy and standards	Enact the e-Health systems Act (HB 10245); mandate HL7/FHIR R4 [26]; adopt ISO/IEC 27799 [32] and IEEE 11073 [33]; establish the Philippine Implementation Guide for FHIR referral resources.
2.	Infrastructure and architecture	Deploy cloud-based national eReferral hub (DOH-KMITS) with edge nodes; implement AES-256 encryption and RBAC per ISO/IEC 27799 [31]; target facilities with IIRS <2.0 for priority connectivity investment; integrate PhilSys for patient identity management.
3.	Digital tools and innovation	Integrate AI-driven triage scoring; blockchain-based audit trails for referral records; FHIR interoperability middleware (Mirth Connect/HAPI FHIR) [27]; offline-first design for low-bandwidth facilities.
4.	Human capital and governance	Establish an HIMSS-aligned health IT competency framework; expand DBM plantilla ICT positions; activate inter-agency coordination among DOH, DOST, DICT, and PhilHealth; engage universities and private ICT developers in national eHealth development.

The proposed framework adopts a five-year implementation horizon to allow for the phased development of policies, infrastructure, digital tools, and human resource capabilities. The REI serves as the primary outcome metric, aiming to increase the eReferral rate from an estimated baseline of <5% to at least 60%. This target reflects a realistic progression toward international benchmarks observed in the NHS (>95%) [25] and US EHR-based referral environments (>80%) [30]. In addition, annual IIRS assessments will be conducted to monitor progress across bandwidth, security, interoperability, and human capital dimensions. These performance indicators provide a measurable basis for evaluating implementation progress and guiding future policy and investment decisions.

5.1. Limitations

This study has several limitations. First, the SWOT factors were derived from literature, policies, and existing reports rather than primary data collected from hospitals and healthcare professionals. Second, the strategies developed using the TOWS matrix are based on strategic analysis and may require further validation through empirical studies or pilot implementation. Future research may include surveys, interviews, and case studies involving hospitals and healthcare professionals to validate the proposed strategies and to assess the feasibility of implementing a national e-Health referral system.

6. CONCLUSION

This study analyzed the current e-Health referral system using SWOT-TOWS analysis to develop strategic recommendations for improving healthcare service delivery. The findings showed that while strong government support, policies, and institutional frameworks exist, challenges such as fragmented information systems, limited ICT infrastructure, lack of standardization, and insufficient technical personnel continue to hinder the effective implementation of an eReferral system. In the context of successful development,

changing the process landscape should require coordination among private and public-sector agents. A multisector team should work together to achieve a national eReferral system. The key to success is coordination, defined as making all the people involved in a plan work together in an organized way, including specialists, hospitals, and facilities. The SWOT–TOWS analysis proved to be an effective strategic planning tool for identifying internal and external factors, formulating strategies, investing more in technological development, such as standardizing eReferral systems, increasing ICT funding, developing centralized systems, strengthening ICT human resources, and improving ICT infrastructure. The proposed strategic framework may serve as a guide for policymakers, healthcare administrators, and ICT planners in developing and implementing a national e-Health referral system to improve coordination, efficiency, and quality of healthcare services in the Philippines.

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This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

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C : **C**onceptualization

M : **M**ethodology

So : **S**oftware

Va : **V**alidation

Fo : **F**ormal analysis

I : **I**nvestigation

R : **R**esources

D : **D**ata Curation

O : Writing - **O**riginal Draft

E : Writing - Review & **E**diting

Vi : **V**isualization

Su : **S**upervision

P : **P**roject administration

Fu : **F**unding acquisition

CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflicts of interest.

DATA AVAILABILITY

The data that support this study's findings are available from the corresponding author, [ECN], upon reasonable request. The data consist of publicly available government reports, policy documents, published literature, benchmarking materials, and derived analytical output used in the SWOT-TOWS assessment. Publicly accessible sources, including documents obtained from government agency websites, are cited in the reference list. Certain supporting materials obtained from participating agencies may be subject to administrative restrictions and are therefore not publicly available.

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APPENDIX

Table 2. TOWS matrix of the electronic health referral system

	S-Strengths	W-Weaknesses
Electronic health referral system	1. The Department of Health facilitates and governs the healthcare system in the country [1]–[3], [9]. 2. The Philippine government has passed amendments to the Universal Health Care Law 2019 [3]. 3. Hospitals in the Philippines must be accredited by PhilHealth before operation [1]–[3]. 4. The presence of government-allied agencies like the Civil Service Commission (CSC), Department of Budget and Management (DBM), NPC, DICT, and DOST [9], [41]. 5. Availability of private health sectors [41]. 6. The National Health Insurance Program (PhilHealth), which the Philippine Government funds, covers affordable healthcare services [2], [3]. 7. Can procure necessary equipment, cutting-edge technologies, and hospital health information management [3], [19], [23], [41]. Has a Joint DOH-DOST-DICT Memorandum that supervises the national e-Health system's continuous development and operationalization [3], [19], [39], [40], [41]. 8. ICT Literacy and Competency Development Bureau: ILCDB – DICT provides competency training for government workers, which includes application/web development and programming [19].	1. Limited budgetary allocations in the public service for technological innovations in healthcare referral systems, as compared to private healthcare [3], [39], [40]. 2. Most of the country's rural areas lack qualified medical professionals and have subpar facilities and broken medical services [20], [43]. 3. Unreliable internet connection due to the area's demographics or the location of some medical facilities [12], [24]. 4. Health infrastructure is outdated and often in poor condition, particularly in rural areas, and requires concerted government efforts to improve [44]. 5. The decentralization of the system, particularly at the local government level, has led to the fragmentation of the health sector [21]. 6. Lack of a system development team in some health agencies [12][40]. 7. Different information systems are used in health information management offered by various providers, both in private and public hospitals [2], [9], [17]. 8. Large web platforms that demand extremely powerful and dependable internet connectivity [12], [21]. 9. Due to unsecured computers, critical information for hospitals is prone to being exposed to attackers or anyone with malicious intent to protect patient data [7], [14], [17], [24].

Table 2. TOWS matrix of the electronic health referral system (*continued*)

O-Opportunities	SO-Strategies	WO-Strategies
1. Presence of tertiary hospitals per region, where rural/municipal health units may refer patients with more demanding health care needs [6]. 2. Increasing multi-specialty centers in the provinces. 3. Call of the President for digital transformation. 4. Department of Information Communication Technology's global partnership with online learning platforms such as Coursera and Google Education programs for upskilling government employees. 5. Availability of Open Source EHR. 6. Project outsourcing and hiring a professional ICT consultant. 7. Possible tie-up with local or international agencies for funding EHR development [5], [9], [12]. 8. Development of one EHR for all, which may be spearheaded or collaborated with DOH-KMITS and PhilHealth [12], [45].	1. Enact a law that standardizes the eHealth referral system among public and private hospitals. (S1, S2, S3, S6, S7, O1, O2, O3, O4, O7, O8) 2. Appropriation of bigger funds for developing ICT projects focused on health care delivery. (S4, S5, S7, S8, O8, O10) 3. Develop a centralized electronic health referral system for all hospitals in the Philippines. (S5, S7, S8, S9, O3, O4, O8, O10)	1. Strengthening the IT service by new plantilla positions. (W6, W9, O5, O7) 2. In partnership and with a joint department memorandum, DOH-DOST-DICT should put in the priority projects the development of the National E-Referral System. (W1, W6, W7, W9, O5, O7, O8) 3. Involvement of private hospital ICT developers and tie-up with local universities and colleges for the technical development of a system for the development of the national e-Health system. (W1, W5, W6, W7, W8 O7, O38, O9)
T-Threats	ST-Strategies	WT-Strategies
1. Better opportunities in the private sector for IT healthcare professionals who can be tapped for the development of referral and EHR. 2. Varied levels of skills of IT healthcare professional staff [12], [21], [46]. 3. Increasing risks of cyber-attacks on hospital systems, compromising patient data. 4. State-of-the-art information systems for hospital operations [12] are only available in hospitals that are at level 3 or higher. However, different providers subscribed to it. 5. There is a lack of knowledge or understanding of the application of health information management among medical personnel [2]. 6. Different providers of hospital systems may compromise system interoperability [9], [22].	1. Nationwide upskilling and competency standards of healthcare IT professionals compliant with global standards. (S8, S9, T3) 2. DICT and DOST will provide the needed secure technologies and will set the standards that will host referral and EHR. (S4, S3)	1. Establishing the infrastructure for a DOH data center. (W1, W6, W7, W8, W9, T1, T2, T8, T9) 2. Investing in infrastructure for network facilities. (W3, W6, W8, W9, T4, T7)

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