eHealth Strategy, Ministry of Public Health (2017 – 2026)

iCT @MOPH
Key of Success

eHealth
THAILAND

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bsi. ISO/IEC 27001
Information Security Management

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Appreciation

H.E. Clin.Prof. Emeritus Piyasakol Sakolsatayadorn, M.D.
Minister of Public Health

The government gives great importance to Digital Economy. This envolves an enormous change in society and subsequently shows consistent emerging patterns of activities in all sectors. Health care systems needs to adapt effectively by taking full and creative advantage of digital technology in order to develop infrastructure, innovation, data capability, human capital, and other resources, thus propelling the economic and social development of the country towards stability, prosperity, and sustainability, with awareness of these changes and development opportunities. The eHealth Strategy is being prepared by the Ministry of Public Health to serve as a framework for driving digital technology. It is a mechanism for the development of the national health system, including paradigm shift, reforming of digital technology operations and health innovation in all sectors.

I hope we will continue to work well together in a more integrated way with all our partners for long-term development and sustainability, to propel the Thai public health values of MoPH (Mastery, Originality, People center, and Humility), which represents the improvement of people's quality of life. The same standard can link health care services with digital technology without separating public and private sectors, in order to provide the public with the best possible benefits and with continuous satisfaction in health services.

I want to thank the administrators and all involved persons who contributed to the success of this paper. I wish you all success, advancement in working life, and a warm, strong and healthy family forever.

H.E. Clin.Prof. Emeritus Piyasakol Sakolsatayadorn, M.D.
Minister of Public Health

Appreciation

Dr. Sopon Mekthon
Permanent Secretary for Public Health,
Ministry of Public Health

The Ministry of Public health started the eHealth strategy since 2015. It got the cooperation of many stepholders and of all involved sectors. They analyzed the guidelines and set the goal of eHealth developement in order for it to become a framework of health ICT Ministry of Public Health 2017 – 2026. This strategy emphasizes the real need of a major benefit of the population. The next mechanism operation will drive the eHealth vision of the Country to the eHealth operation plan and will evaluate the eHealth systematically. To develop the eHealth strategy is necessary and importantant, as the WHO has stated, urging each country to work for its achievement.

The Secretariat of The Prime Minister at The Secretariat of the Senate concerns and supports the Ministry of Public Health in order to be the leader authority in the development of the eHealth strategy. I need to thank all professionals and sectors involved for helping making it possible and indispensable for all healthcare sectors, in order to launch the eHealth Strategy which will prove to be a huge step forward in the direction of getting a smart healthcare system in Thailand.

Dr. Sopon Mekthon
Permanent Secretary for Public Health,
Ministry of Public Health

Appreciation

Dr. Suwannachai Wattanayingcharoenchai
Deputy Permanent Secretary of Public Health
Chief Information Officer (CIO),
Ministry of Public Health

First of all, I would like to congratulate Dr. Polawat Witoonkolchit, The Director of Information Technology Center and the team for initiating and developing the concept for the eHealth Strategy, Ministry of Public Health, 2017 – 2026. It is another important step for Thailand to develop a system to improve the quality of healthcare and a concrete operational strategy which is in line with Thailand 4.0 policy and the Digital Economy.

My experiences in regional health management and departmental management make me more aware of the importance and necessity of this eHealth Strategy, which will be very useful for all public health sectors in Thailand to use as a guideline to develop healthcare system or to serve as a driver for innovation in the nation's health ICT sector. Modern information technology optimizes the service as well as achieves the final results, which are healthier lie for people and a better satisfaction in health services.

At various stages of eHealth Strategy development, this book has been discussed extensively by qualified groups including administrators and practitioners in both central and provincial levels of the Ministry of Public Health.

I appreciate and thank all who have contributed in making this book and I send them all my good wishes. Let this effort succeed in both short and long term development to become a basis of a Smart Health Care.

Dr. Suwannachai Wattanayingcharoenchai
Deputy Permanent Secretary of Public Health
Chief Information Officer (CIO), Ministry of Public Health

Editorial

Asst. Prof. Polawat Witoolkollachit, MD, M.Sc. (IT-M)
Director of Information and Communication Technology Center
Office of The Permanent Secretary,
Ministry of Public Health, Thailand

This is the 1st edition of eHealth Strategy, Ministry of Public Health (2017–2026) which will be distributed to all agencies, in particular to the agencies depending on the Ministry of Public Health.

This edition updates the contents of Chapter 1 and Chapter 6, by bringing Thailand Digital Landscape to Health 4.0, and it aligns with the 20-year national strategy on public health and Digital Economic and Social Development Plan. It represents a guiding framework for all public, private and civil society organizations to digital technology operations. Using Information and Communication technologies can increase the access to healthcare of people. eHealth is a bridge connecting the community with health service systems and a tool which reduces geographical and relative gaps between people and caregivers.

The Ministry of Public Health is responsible for directional coordination of Public Health in Thailand. MoPH has studied, analyzed and synthesized the linkages between patient care practices, health promotion and healthy development of healthy behavior with the use of digital technology resources. In order to get the appropriate eHealth Strategy, MoPH has been opened to all sectors to participate. It can also be said that "public" is involved in comments. The results of the public hearing of the Six Strategies have produced a positive feedback: over 80% of participants agree and support the use of this strategy as a guideline to improve the quality of life for Thai citizens.

As the government is making a huge effort for public sector to reform under its "Thailand 4.0" strategy, the beginning of value innovation is needed. This includes the adjustment process in the management of both value chain by creating a holistic answer. Then working with best practitioners. It enables the creation of new platforms in the excellence public health system which will result in a sustainable leap forward. It's time to develop an eHealth Master Plan for Thailand which will bring our energies of work to achieve common goals.

I hope that the main stakeholders in this process, especially public health agencies and those responsible for ICT in Thailand, could make of this eHealth Strategy a master plan for Thailand that can be used in the real world.

Asst. Prof. Polawat Witoolkollachit, MD, M.Sc. (IT-M)
Director of Information and Communication Technology Center
Office of The Permanent Secretary,
Ministry of Public Health, Thailand

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Spread of digital technologies sets enormous change in society and subsequently shows consistent emerging patterns of activities in all sectors, and also affects the economy of the country. Health care systems need to adapt effectively by taking full and creative advantage of digital technology to develop infrastructure, innovation, data capability, human capital, and other resources, thus propelling the country's economic and social development towards stability, prosperity, and sustainability.

To increase the opportunity for people for getting through medical and health services with equality, including adapting to advanced society with digital technology, and also increasing the opportunity to develop an effective health care system is the challenge of the country.

The National Strategy comprises six strategies, aimed to enhancing national security in all aspects; in which aspects of developing and empowering human capital; broadening opportunities to improve social equality and equity; improving public administration. All of these are related to the strategy of Ministry of Public Health, which is the main organization in health care system development of the country. We aim to achieve these aspects with the health strategic development and management of the health system.

Along with Thailand 4.0 by digitally connected health care system of the future. Which includes efficient health care, success in reducing costs in public health management, seamless and secure sharing of healthcare data, relevant laws for controlled exchange of data between applications. These will help Ministry of Public Health create opportunities for innovation and adding value to health care services. Which will bring the development and participation in the health system to create value in a long-term for sustainable development.

Ministry of Public Health (MoPH) has driven the digital health system through the eHealth Strategy, which focus on development that is in line with the Digital Economy plan. And also considering the factors involved. Included synthesis of international digital and eHealth strategies to address many public health challenges, such as:

- Service units under the Ministry of Public Health can be safely linked to the MoPH Intranet and meet international standards.

- High speed Internet service expansion to all Health Promoting Hospitals nationwide.

- Serves Government Information Network (GIN) that connects all community hospital together to support various public health services efficiently, constantly, and continuously.

- Data Backup Management of Regional hospitals and General hospitals nationwide.

- Smart Service Prototyping (PHRs, EMR, Registration) including health products in the unit readiness.

- Increasing Economic Value by developing self-care knowledge with personal electronic health records (PHRs).

- Legislation in modern health systems is linked to the implementation of the Digital Economy and Social Development Plan.

- Large-scale Health Digital Literacy Management is a good source of health knowledge for Thailand. People can reach and use it quickly. It helps to answer the question, to prevent misunderstandings that may pose risks to human health, suppress the spread of distorted information in social movements.
- Ensuring quality TeleHealth System for supporting diagnostic and counseling services between medical specialists and doctors in distant hospitals, especially marginalized rural areas.
- Human resource development in the health system has the potential to utilize digital technology to streamline workflows.
- Integration of health information linkages between agencies in the Ministry of Public Health.

With awareness of these changes and development opportunities. The eHealth Strategy is being prepared by the Ministry of Public Health to serve as a framework for driving digital technology. It is a mechanism for the development of the national health system, include paradigm shift, reform of digital technology operations and health innovation in all sectors. Both public and private, manufacturing sector and health services. Which is the performance improvement to improve people's quality of life.

This will lead to the stability, prosperity and sustainability of Thailand in accordance with the government policy.

Preface

[1]WHO broadly defines eHealth as the use of ICT for health. eHealth has the potential to address inequities in health systems and services in countries. WHO aimed to explore developments in eHealth since the last survey in 2010 and the role it plays in achieving universal health coverage (UHC). The impetus for the global surveys on eHealth came from the increasing use of information and communication technologies (ICTs) in support of health services in both developed and developing countries since the early 2000s. This was acknowledged by the World Health Assembly in resolution WHA58.28 (2005): "eHealth is the cost-effective and secure use of ICT in support of health and health-related fields, including health-care services, health surveillance, health literature, and health education, knowledge and research."

UHC is part of the "post-2015" agenda geared to meet the Sustainable Development Goals (SDGs) adopted by the UN General Assembly in September 2015. Goal 3 is to "Ensure healthy lives and promote well-being for all at all ages" and its target 8 is to "Achieve universal health coverage", so that all people receive the high-quality health services they need without suffering financial hardship. This presents an opportunity for eHealth to support a comprehensive and coherent approach to health and support integrated, people-centred health services.

What is eHealth?

"Health" is a state of complete physical and mental well-being, looking after ourselves, looking after loved ones and receiving care. Health isn't just on or off. We aren't simply ill one day and healthy the next. We're all on a spectrum and we are all unique.

So, what does the e stand for?

'e' is electronic technology that we are already familiar with like computers, mobiles and tablets, the internet and social media. Together they comprise 'eHealth' eHealth is...Better healthcare and a healthier life through digital technology.

As an outgrowth of the Digital Revolution characterized by "the mass production and widespread use of digital logic circuits, and its derived technologies, including the computer, digital cellular phone, and the Internet," some organization used the term of Digital health instead of eHealth.

Digital health is defined as the "use of information and communications technologies to improve human health, healthcare services, and wellness for individuals and across populations."

This eHealth Strategy, will use the term 'eHealth' which is very commonly used in the international perspective.

eHealth is a relatively recent term for healthcare practice supported by electronic processes and communication. The term can encompass a range of services or systems that are at the edge of medicine/healthcare and information technology, including:

Electronic health record: enabling the communication of patient data between different healthcare professionals (GPs, specialists etc.);

Computerized physician order entry: a means of requesting diagnostic tests and treatments electronically and receiving the results.

ePrescribing: access to prescribing options, printing prescriptions to patients and sometimes electronic transmission of prescriptions from doctors to pharmacists.

Clinical decision support system: providing information electronically about protocols and standards for healthcare professionals to use in diagnosing and treating patients.

Telemedicine: physical and psychological diagnosis and treatments at a distance, including telemonitoring of patient's functions;

Consumer health informatics: use of electronic resources on medical topics by healthy individuals or patients;

Health knowledge management: e.g. in an overview of latest medical journals, best practice guidelines or epidemiological tracking;

Virtual healthcare teams: consisting of healthcare professionals who collaborate and share information on patients through digital equipment;

mHealth: includes the use of mobile devices in collecting aggregate and patient level health data, providing healthcare information to practitioners, researchers, and patients, real-time monitoring of patient vitals, and direct provision of care (via mobile telemedicine);

Medical research using grids: powerful computing and data management capabilities to handle large amounts of heterogeneous data.

Health informatics / healthcare information systems: also, often refer to software solutions for appointment scheduling, patient data management, work schedule management and other administrative tasks surrounding health

Even the definition of eHealth is broad and diverse. But in summary, "eHealth is digital technology and ICT services which achieve wider interoperability between health care provider and citizen by enabling accessing of health services to improve the safety, quality and efficiency of patient care. "

Digital technologies are becoming more widespread and new e-services will be able to contribute to improvements in health care and to enable the formation of innovative new care concepts future needs and requirements. This will only increase a combination of health care and it has long been considered an opportunity for MoPH organizations to progress on the eHealth implementation. Furthermore, technological advances have changed how patients and healthcare providers regard health information. The advances in eHealth need to be put in context of local conditions to make judgments on successful factors and generalizations.

Access to information is important for enabling effective collaboration between patients and their healthcare providers. Use of information systems (IS) in patient-centered care renders an opportunity to provide individuals access to their own health information as well as other resources.

Benefits of eHealth

eHealth offers many benefits. That is why MoPH is encouraging the healthcare sector to provide more eHealth services. The benefits of eHealth include:

- **Time savings**

  Telehealth can save time. For example, patients can schedule their own appointment with their care provider online. And they do not even need to leave their home if they can arrange an online consultation (by video link, for example).

- **Insight into own health**

  A personal digital healthcare environment gives people more insight into their health. If they wish, they can share all or part of their data with a healthcare provider or informal carer, so that they do not have to repeatedly relate their entire medical history. This allows the healthcare provider to work more effectively, determine the right treatment more quickly, and avoid mistakes. Patients gain more control over their own health thanks to a greater understanding of their health situation.

- **Lower administrative burden**

  Doctors have less paperwork and can share information securely and easily with colleagues. Most importantly, care will be oriented toward patient needs, patient satisfaction, and exceptional patient outcomes.

eHealth provides the following benefits to patients:

- An increase in patient safety through a reduction in medical and clinical adverse events.

- Treatments can be recorded and test results returned more quickly than before to enable better diagnosis and better care.

- Improved communications between the patient and the carer.

- Personal health records will be available wherever they are needed even when we're away. People can recieve care remotely and get on with their lives.

- Reduction in length of stay due to improved operational efficiency.

- Rapid intervention during critical periods of care facilitated by real time alerts and reminders.

- Improved medications management.

- Access to modern day electronic media and social information

eHealth provides the following benefits to healthcare professionals:

- Better sharing of information: Secure digitisation of records will reduce paperwork and produce better quality data that can be shared securely for improved efficiency.

- Reduction in transcription, legibility and omission errors.

- Secure, high quality information drawn from a variety of sources will enable professionals to offer more informed diagnosis and appropriate treatments.

- Enhanced ability for clinicians to coordinate care because of simultaneous access to the electronic record.

- Reduced time locating/collecting patient information.

- Decreased number of avoidable clinical incidents.

- Reduction in the number of unnecessary administrative tasks, meaning clinicians will have more time to communicate with patients about their care and needs.

Developing eHealth requires a strong eHealth strategic framework to set the mission. "For the efficiency of information and communication technology to improve health care delivery. Health management and communication".

The goal is; access to public health services at all levels. This should be treated with quality. In addition, health agencies can also be making eHealth work. Research related to public health, health reporting and humanitarian operations.

ehealth is concerned about the development of interconnected health systems to improve the use of computational technologies, smart devices, computational analysis techniques and communication media to aid healthcare professionals and patients manage illnesses and health risks, as well as promote health and wellbeing.

Chapter 1 : Introduction

Asst. Prof. Polawat Witoolkollachit, MD.

1.1 Background

Digital technology is constantly changing and inevitably influence people's way of life. The pace of innovation is incredibly fast with new things being discovered daily. It also affects the operations of the business, government and civil society and all organizations. Health system needs to concern and be aware of the technological changing. Including the impact of the future digital technology changes.

Disruptive innovation is a term in the field of business administration which refers to an innovation that creates a new market and value network and eventually disrupts an existing market and value network, displacing established market leading firms, products, and alliances.

Disruptive innovation has brought affordability and convenience to customers in a variety of industries. [2]Here are examples of the most disruptive technologies:
1. Internet of Things (IoT) 2. Artificial Intelligence 3. Space Colonization 4. 3D Printing 5. Medical Innovations: there are many medical innovations that are in existence and being further trialled. These include vaccines that were not there before, genomic directed clinical trials, gene editing using CRISPR, cell-free fetal DNA testing, cancer screening through protein biomarker analysis, frictionless remote monitoring and more. 6. High-Speed Travel 7. Robotics 8. Blockchain Technology 9. Autonomous Vehicles 10. Advanced Virtual Reality 11. Renewable Energy.

However, disruptive technology is already in development for many problems in healthcare. Hundreds of thousands have access to their genetic data, revealing what medical conditions they are susceptible to. Wearable devices let us measure vital signs and health parameters anywhere, not just in the doctor's office. The precision of surgical robots lets doctors perform previously impossible procedures.

Disruptive medical innovations could change healthcare for the better. Technology in the clinic has been shown to help doctors spend more time with each patient. What's more, with telemedicine, smart algorithms and health trackers making it possible to stream medical data from every home, patients wouldn't have to wait weeks for a doctor's appointment or have to diagnose themselves, but would get the help they need near instantly.

If we do not embrace disruptive technology, the doctor-patient relationship may change forever – for the worse. Patients who are entrepreneurial and skilled enough can hack their own health which might lead to biological differences because of financial and resource disparities.

To embrace disruptive medical technologies, the following steps must be taken:

1. Improving medical training, combining digital & health literacy to prepare a generation of physicians who are open to technology and innovation. Courses such as the Social Media Course can teach doctors how to use social media to engage with patients and peers.

2. Educate patients to make most of new technologies, and take the reins of their own health. Provide great, reliable online resources on hundreds of diseases.

3. Healthcare agencies and regulators like the FDA must understand the coming changes – both the dangers and the value that can be gained. Passing the Law to protect sensitive patient data and organizing a Patient Advisory Board to include patients in designing healthcare are promising steps forward. Only understanding can arm regulators to walk the narrow tightrope between opening up space innovation and protecting all healthcare stakeholders from the dangers of rampant technological change.

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[2] https://richtopia.com/emerging-technologies/11-disruptive-technology-examples

Challenges from the dynamics of digital technology that affect health systems.

Today, everything is affected by the digital revolution – the impact of new technology on improving the health and well-being of individuals, communities, and populations is unprecedented. Recent technological achievements have revolutionized clinical practice, from prevention through diagnosis, monitoring to disease management, and enabled unprecedented public interest and engagement in self-management and well-being.

The use of digital technology to deliver a new approach to connect all sectors and people to achieve health care systems. The partnership can play a role and participate throughly and equality, especially digital innovations for value creation and competitiveness at the international level, as well as upgrading "Quality of life" of the people in the country.

Policy makers can use advanced technology to cope with new challenges. Such as creating and utilizing health information from various sources. Social media and data are stored by device and flowed through the internet of things. To analyze through a large processing system and to take advantage of improving production efficiency in production. Service and Infrastructure Management Development. The operation will generally continue to change.

Operators need to have knowledge and must be trained to be able to cope with the challenges of new technologies. The policy makers will be able to use some specific technologies for improving productivity and increases capacity. This will make public service delivery more efficiency and effectiveness. Government agencies will balance their need to foster technological growth with responsibility for the social welfare. Because new technology will change the economical model and people's lifestyle.

Creating competitive advantage in the digital era, by using information and communications technologies to improve human health, healthcare services, and wellness for individuals and across populations. This will create opportunities for all people to participate in creating a healthy system and creating the digital health for everyone.

In this era of globalization, [3]health care stakeholders are seeking disruptive innovation to transform the U.S. health care sector in the years ahead. Which first consider where respondents feel disruptive innovation in health care is most needed. Hospitals and health systems top the list, with nearly two-thirds of respondents putting this among their top three sectors in need of innovation. These results are particularly notable because Insights Council members are themselves based at organizations directly involved in health care delivery. Executives, clinical leaders, and clinicians are roughly equal in assessing the need for innovation at hospitals and health systems.

Health care IT (for vendor technologies such as EHRs and clinical decision support) and primary care, register second and third among sectors most in need of innovation, at 47% and 36% respectively. Specialty care lands much farther down the list, with only 18% of respondents placing it among their top three sectors. As Figure 1.1 New Marketplace Insights Report.

[3] Leemore Dafny, PhD & Namita S. Mohta, MD. New Marketplace Survey: The Sources of Health Care Innovation.Insights Report · February 16, 2017. Harvard Business School.NEJM Catalyst.

Health Care Sector Most in Need of Disruptive Innovation

**Please rank the top three health care sectors that are most
in need of disruptive innovation.**

Net Top 3 Rank
(Multiple responses)

Sector	%
Hospitals/Health systems	65%
Health care IT (vendor technologies such as EMRs and clinical decision support)	47%
Primary Care	36%
Pharmaceuticals	34%
Commercial payers	33%
Public payer (Medicare/Medicaid)	31%
Specialty care	18%
Healthcare IT(consumer-based technologies)	13%
Nonacure care	13%
Medical devices	5%
Sevices(e.g., strategic consulting)	3%
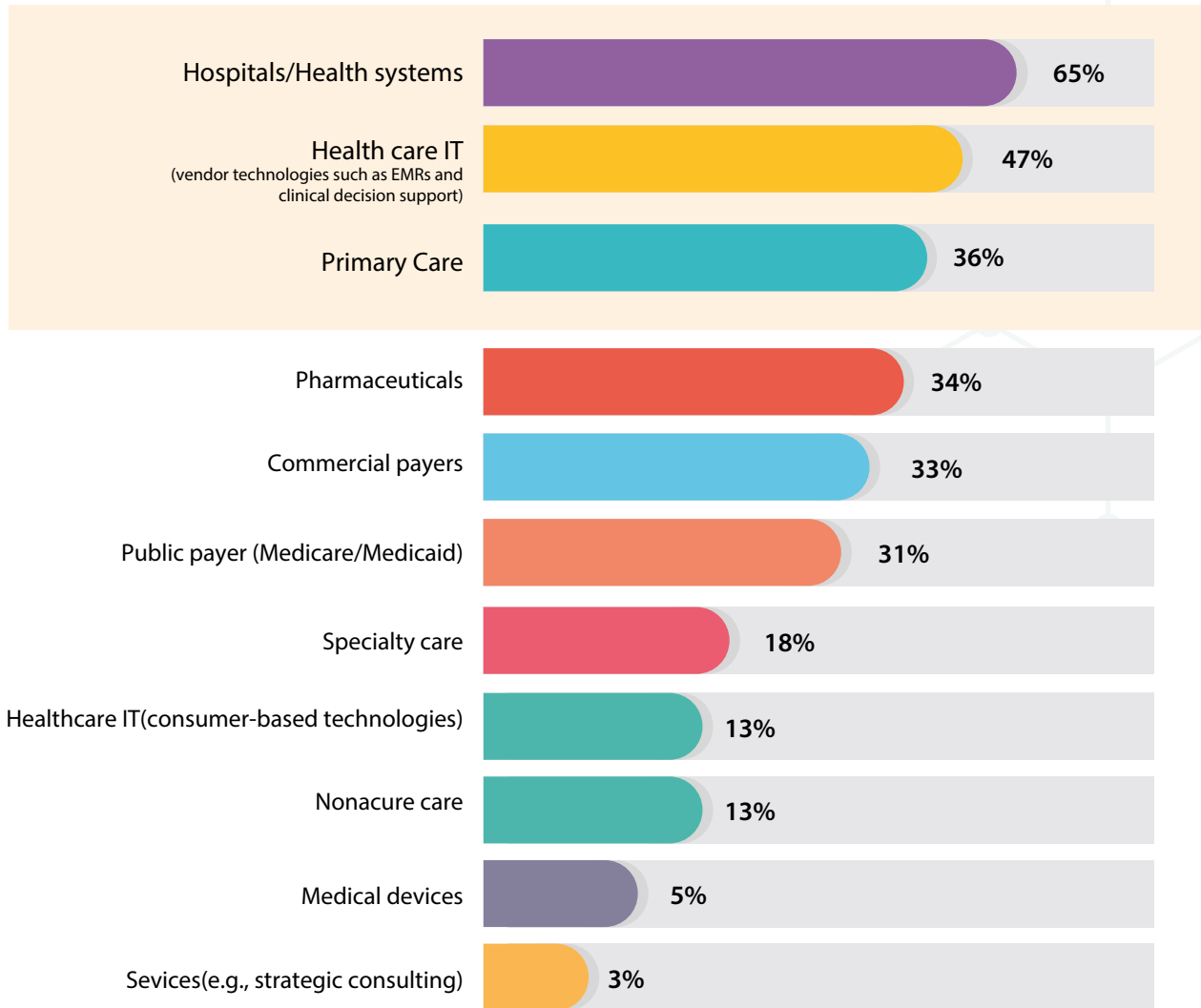
1st Rank by Organization Type

Organization Type	%
Provider organnizations — Hospital/Health systems, Primary care, Specialty care, Nonacute care	56%
Vendors and suppliers — Health care, IT (vendor technologies such as EMRs and clinical decision support), Health care IT (consumer-based technologies) Services (e.g., strategic consulting), Pharmaceuticals, Medical devices	34%
Payers/Insurers — Commercial payes, Public payers (Medicare/Medicaid)	14%

Base = 519
NEJM Catalyst (catalyt.nejm.org)© Massachusetts Medical Society

Figure 1.1 Health Care Sector Most in Need of Disruptive Innovation

1.2 Driving the growth of eHealth

Thailand successfully achieved universal health insurance coverage in 2001. The benefit package is comprehensive and includes general medical care and rehabilitation services, high cost medical treatment, and emergency care. The scheme has increased access to health services and reduced the incidence of catastrophic health expenditures. While it is not dedicated to the poor and it is found an unfair for Thai citizen to access health care services.

There are also found unbalanced distribution of health personnel and medical technology between and within countries.

With rapidly advancing medical technology, patient care is more efficient and effective. But at the same time, there is a huge cost burden. It is a challenge to increase competitiveness and reduce disparities in access to public health and public health services.

Driving the operation of the health service system effectively needs Information Technology and Health Innovation to manage and support operations. In order to increase the opportunity for people to get medical services and new health innovations, throughly and equality.

WHO[4] has explored developments in eHealth from 125 WHO Member States and presented them to the

Sustainable Development Goals (SDGs) meeting which adopted them at the UN General Assembly in September 2015. Goal 3 is to "Ensure healthy lives and promote well-being for all at all ages". This presents an opportunity for eHealth to support a comprehensive and coherent approach to health and support integrated, people-centred health services

This concept is in line with the policy of Thailand 4.0 which is driving a new economic growth and affects a new way of life in all sectors of society. Bringing technology to support the Thai health system is necessary to set a common guideline for action. Through new way of thinking, new learning processes create a modern working model and are driven quickly. This is a challenging context for Thailand to elevate facilities, fast and accurate service to public.

Thailand 4.0 focuses on a "value-based economy," as the country needs to deal effectively with disparities and the imbalance between the environment and the society. In the second element, Thailand will move toward an "inclusive society" with equitable access to the fruits of prosperity and development in which the Ministry of Health is directly involved with Health, Wellness and Bio-Med.Thus, there are roadmaps in the creation and development of medical infrastructure to promote Thailand as a Medical Hub of ASEAN by 2025 (Figure 1.2)

1-5 years	5-10 years	10-15 years
• Generic drug substitution of imports. • Bio-type biopharmaceuticals • Biopharmaceutical and pro biotics products • Herbs and cosmetics • Smart Medical and Devices Robotics to help people with disabilities. • Elderly rehabilitation center • Healthy food and products • Health Tourism	• Generic drug substitution of imports. • A new biopharmaceutical for cancer and allergy. • Advanced vaccines • Potential diagnostic commerce kit • Medical robots that meet international standards. • Quality Reagents for Automated Diagnostic Devices • Smart Village for the elderly • Digital Health • Precision Medicine	• New Small Molecules • Targeted Therapy • New types of vaccines. • New biopharmaceutical • Medical robots and surgical instruments • Implanted Devices • Autonomous Diagnostic Devices • Specialized Target • Therapeutic Institute

Figure 1.2 Roadmap for Health, Wellness and Bio-Med

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[4] WHO. Global diffusion of eHealth: making universal health coverage achievable. Report of the third global survey on eHealth. 2016

However, medical and health technology are unavoidably associated with Smart Devices, Robotics & Mechatronics, and Digital Internet of Things, Artificial Intelligence & Embedded Technology. In addition, public health economics must take into account Creative, Culture & Value Service to add value to the health industry.

Ministry of Public Health has developed information and communication technology aligned with the 20-year National Strategy, the 20-year strategic plan of the Ministry of Public Health, Thailand 4.0 and the Digital Economy and Social Development Plan. Ministry of Public Health is aiming to enter Thailand 4.0 in public health or Health 4.0 with the following details:

1.3 Vision, mission, values related to health development, Ministry of Public Health.

Vision: Strengthening Health System to make Thailand a stable, prosperous, and sustainable nation.

Mission: Strengthen, support and coordinate the participation of all sectors, both public, private, academic and civil society. To strengthen and supervising the development of the Thai health system. Support for the context of future changes.

Goal

1. Citizens, local communities and networking parties gain more knowledge about health. As a result, illness and death from preventable diseases decrease.
2. All Thai people are in a good health. Premature death is reduce.
3. Enhance the capacity of the health service system at all levels. Allow people to access services conveniently. 4. To get the right health workers with the right skills in the right place and doing the right things.
5. Effective national health care systems.

Oganizational standpoint

Central: Develop policies to monitor and evaluate.

Provincial: Service Unit Management, Propel policy into action.

Ministry of Public Health has set 4 Excellence Strategies to bring the organization forward, which consists of the following main strategies:

1. Prevention & Promotion Excellence; refers to the development on health promotion, disease control and prevention with emphasis on health promotion. This excellence area aims to bring health care in all age

groups including: the development of Thai quality of life for all age group, disease prevention and health hazards, food safety and reducing the major risk factors for noncommunicable diseases (NCDs) and environmental management.

2. Service Excellence; focuses on the health service system, emphasis on primary health care, Service Plan and Excellence Center. This service area also focuses on the service with a smile by which people who come for services will be impressed, including development of primary medical system, Health Service System Development, Medical Excellence Center, National Health Center / Special Economic Zone.

3. People Excellence refers to: building the capacity of health personnel to achieve excellence in all areas, along with happiness which are included; Health workforce planning, production and development, effective human resources management, development of public and private health networks.

4. Governance Excellence refers to building an effective management system with emphasis on information technology, modern financial systems, health information system, health insurance system, drug and medical security, consumer protection and good governance.

1.4 Health in Thailand ; Health 4.0 connects health services with digital technology.

Driving Thailand 4.0 to Health 4.0 is essential to integrate eHealth Strategy into a framework for moving in the same direction in order to be successful in the long run. The same standard can link health care services with digital technology without separating public and private sectors. To provide the public with the best possible benefits and continuous satisfaction with health services.

Digitally connected health care system of future consists of:

- Effective health care.
- Success in reducing public health management costs.
- Information related to health services can be linked and exchanged with security, seamlessly and protected by applicable law. - Create Opportunities for innovation development and adding value to services.
- Participatory and Sustainable management in health care services.

Driving to Thailand 4.0 in the Public Health area. The Ministry of Public Health has defined the vision aimed to value-based health care and formulated strategies and mechanisms to propel 3 engines 10 key issues over a 5-year period (2017 – 2021), clearly as follows;

1. Inclusive growth engine. The issue consists of:
   - Smart Citizen: Smart kids & Aging (integration of 4 ministries), Aging Enterprise Complex & Intermediate Care
   - PP & P: Smart EOC, Village health volunteers 4.0, Smart Protection
   - Service: One Day Surgery & Minimally Invasive Surgery, Primary Care Cluster (PCC), Universal Coverage for Emergency Patients (UCEP)
   - Digital Health: Digital Hospital (EMRAM)

2. Productive growth engine. The issue consists of:
   - Biotech : Biopharmaceutical, Precision Medicine
   - Health Tech: Meditech Innovation
   - Herb: Herbal City
   - Health & Wellness: Abhaibhubate Model

3. Green growth engine. The issue consists of:
   - Food Safety
   - Green & Clean Hospital

A driving structure consisted with eHealth strategies such as human resources (HR Transformation), the Health Care Financing Reform, the National Health Policy Organization (NHPB) and the National Information Technology Information Center (NHIS) [5].

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5 Brochure: Thailand 4.0 Public Health 5 Years 2017-2026, Workshop To develop Thailand Strategic Plan 4.0. Public Health 10 Years (2017-2026) 4-5 April 2016 at TK Palace Hotel & Convention Laksi Bangkok.

1.5 Thailand Digital Landscape to Health 4.0

eHealth Strategy, Ministry of Public Health focuses on sustainable long-term development. Like the Digital Economy, the 20-year national strategy, the 20-year strategy of Ministry of Public Health. Therefore, the digital landscape of Thailand in the past 20 years has been applied to the direction of the development of health in Thailand to Health 4.0 as shown in Figure 1.5.

The Digital Thailand Plan aims for long-term development and sustainability, in accordance with the country's 20-year strategy. Digital technology, however, is fast changing and therefore requires the digital landscape to be structured in phases as follows:

    1 Year 6 Months Digital Foundation
    5 Years Digital Thailand I: Inclusion
    10 Years Digital Thailand II: Full transformation
    10 - 20 Years Golbal Digital Leadership
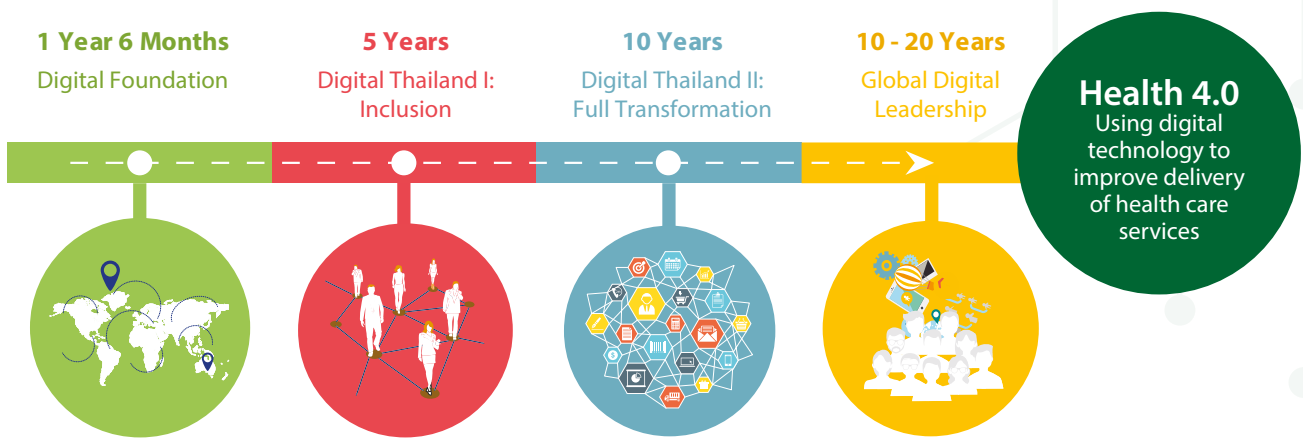
Figure 1.5 Thailand Digital Landscape to Health 4.0

Source: Thailand Digital Economy and Society Development Plan, Ministry of Information and Communication Technology:2016:12

However, the eHealth Strategy, Ministry of Public Health (2017 – 2026), is based on the WHO eHealth concept (2016) and the International Telecommunication Union (ITU), which focuses on public health by provinding information and communication technology to help people get healthy, fair, and safe health services. It is a good practice for all countries around the world to apply these concepts, in which they also need to consider the situation of public health status problems. In addition to analyzing the problems of the information technology system of the Ministry of Public Health. We focus on the following components:

1. eHealth foundations
2. Legal frameworks for eHealth
3. Telehealth
4. Electronic health records
5. Use of eLearning in health sciences
6. mHealth
7. Social media
8. Big data

The vision and goal of eHealth development, despite they focus on continuous and sustained development, are in line with the 20-year national strategy, but so that eHealth can support the dynamics of digital technology and eHealth's global approach to operations. It has set four development paths leading to success in the development of the designated. As the vision and goal of eHealth that states "The achievement of health sector goals".

eHealth is the cost-effective and secure use of ICT in support of health and health-related fields, including health-care services, health surveillance, health literature, and health education, knowledge and research.

Developing eHealth requires a strong eHealth strategic framework to set the mission. "For the efficiency of information and communication technology to improve health care delivery. Health management and communication ", with the goal of accessing public health services at all levels. This should be treated with quality.

4 phases of eHealth Development are as follows:

Phase 1 Investing and Building a foundation for eHealth Development.

Phase 2 eHealth Inclusion: all sectors of Thailand are involved in eHealth operations.

Phase 3 eHealth Transformation: Thailand steps into eHealth to propel health system by leveraging digital innovation to reach its full potential.

Phase 4 eHealth Leadership: Thailand is a healthy developing country where digital technology can create real economic value in the public health system and people have good quality of life.

1.
Investing and Building a foundation for eHealth Development

2.
eHealth Inclusion: all sectors of Thailand are involved in eHealth operations.

3.
eHealth Transformation: Thailand steps into eHealth to propel health system by leveraging digital innovation to reach its full potential

4.
eHealth Leadership: Thailand is a healthy developing country where digital technology can create real economic value in the public health system and people have good quality of life.

กระทรวงสาธารณสุข
MINISTRY OF PUBLIC HEALTH

1.6 Purpose of eHealth Strategy Development

1. To provide a framework and guidelines for implementation of the eHealth Strategy through the concept of senior management, and the participation of different sectors. In order to achieve good governance as well as investment, instruction, development and assignment of personnel needed and link to other relevant part of the eHealth system's network.

2. To senior executives and relevance partnership understanding strategic goals of eHealth, which will bring information and communication technology to increase the quality and efficiency of medical and public health services to the maximum benefit of the people.

3. To develop eHealth interoperability & standardization for connecting eHealth services getting the right standards in architecture, hardware, software, networking, health information system and personnel involved in information and communication technology.

4. To encourage organizational leaders to use eHealth strategic planning and strategy implementation processes to achieve greater success.

Chapter 2 : eHealth Strategy Development Concepts

Editorial board

A health system consists of all organizations, people and actions whose primary interest is to promote, restore or maintain health. This can be descripted in the six building blocks of WHO framework that consist of: 1) Service Delivery, 2) Health Workforce, 3) Information, 4) Medical product, Vaccine and Technology, 5) Financing, 6) Leading / Governance. See Figure 2:

SYSTEM BUILDING BLOCKS

SERVICE DELIVERY

HEALTH WORKFORCE

INFORMATION

MEDICAL PRODUCTS, VACCINES & TECHNOLOGIES

FINANCING

LEADERSHIP / GOVERNANCE

ACCESS COVERAGE

QUALITY SAFETY

OVERALL GOALS / OUTCOMES

IMPROVED HEALTH (LEVEL AND EQUITY)

RESPONSIVENESS

SOCIAL AND FINACIAL RISK PROTECTION

IMPROVED EFFICIENCY
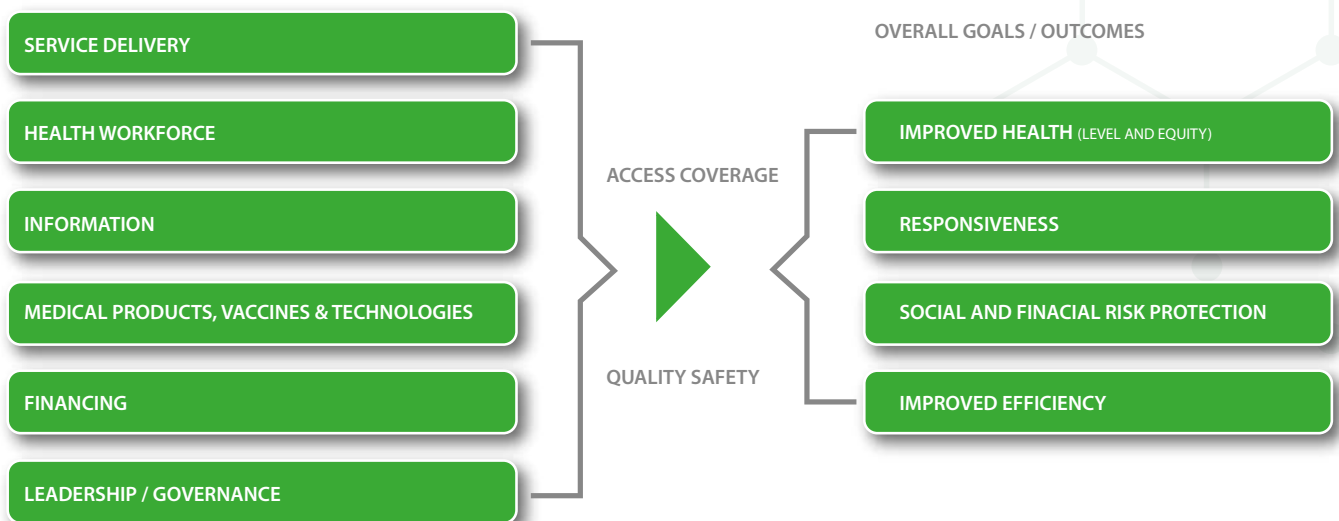
Figure 2: The six building blocks of a health system: aims and desirable attributes,
Source: WHO 2007 http://www.who.int/healthsystems/strategy/everybodys_business.pdf

ICT can contribute to strengthen the six building blocks. The result will be several intermediate outcomes, which are: Access Services, Coverage, Quality, and Safety, which will result to be an outcome to all four systems: Improve health, Responsiveness, Social and Risk protection and Improved efficiency.

2.1 Situation and problems in Health Information System

The National Health Development Plan identifies the situation and problems in the health information system. The utilization of health information and Research System was found to be far below the national expectation. Health literacy is not enough to prevent health risks. The national health system governance is not clear.

The strategic issues of Thailand 4.0 and Sustainable Development Framework (SDGs) have been identified as critical to strengthen health information system inputs and concrete feedbacks with establishment of functional health management information system are equaly important. To strengthen and continuously improve health sector, capacity building, standardized and integrated data collection and reporting. To empower linkage between information sources, information use, action-oriented performance monitoring and use of appropriate technology.

Strategic guidelines development are as follows:

To develop health care support system, health information system, health care financing, including medicines and health technologies.
- Developing decision support systems for the use of health technologies, promote and support research to develop technology and new innovations for self-reliance healthcare.
- Development of drugs and medical technology systems in the country.
- Strengthen mechanisms and processes in data management.

1. Establish health information system standards and improve the interoperability of healthcare information systems.
2. Develop a health data warehouse.
3. Develop Personal Health Record.
4. Develop digital health technologies

The goal 3 of Thailand 4.0 states that it is necessary "To provide health care systems at all levels with enhanced capabilities, standardized quality, modern service, sufficient and justified distribution of health care delivery. There are advanced medical technologies in which Thai people have access to services that are convenient and appropriate, with the integration and participation of all sectors."

Strategy 2, Creation of fairness aimed to reduce disparities in health services. It discusses the use of appropriate and cost-effective medical technology in every health area. Past events have showed how The Ministry of Public Health has encountered problems distributing expensive medical equipment and high technology. The cost of access to expensive technology varies widely between different groups of people and regions. If there was a good availability of appropriate and cost-effective medical technology in all health areas, we would get a fast and efficient delivery system, a developing emergency medical services system. People would have to access services easily and would not suffer financial hardship. This would help reducing health disparities, and service recipients would be more satisfied.

Following the Strategy 4, Governance Excellence should include the provision of accurate, complete, timely health information systems, efficiency pharmaceutical and effective medical technology. It should develop a health consumer protection system too.

[6]Secretariat of The Prime Minister at The Secretariat of the Senate made a survey about Thai Health Information System. The result of the study revealed that Thailand has many separated health information systems. Most of them deal just with the management problem and disbursement of medical expenses. There are many duplicate projects. This uncoordinate information systems do not meet the needs of users and the public. These systems can not be integrated or exchange any form of data. There is lack of action in laying the groundwork for the health information system especially about standard health information, safety laws, and privacy issues.

In addition, Thailand has no national agency to formulate strategy, framing, developing, and guiding health information systems. Medical and public health personnel spend more than 40 percent of their time working on reports and information in which wanted by someone else. They can not benefit from the use of information systems, it makes public health services ineffective as they should, and people can not access and utilize their health information.

Secretariat of the Prime Minister has prepared Policy proposal for the development of the health information technology system of the country as follows;

1. Thailand should have a national organization that sets the direction for strategic development. Establish policies and plans for the development of information systems and health information technology in the country. This organization or central body should consist of people from all agencies involved in information systems and health

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[6] More details in the Commission 3 The Secretariat of the Senate. Study Report Thai Health Information System. 2013: Page 34

technology, both public and private. It should be an independent agency such as a public organization.

2. Define policies and strategies for the development of the health information technology system of the country as along with other development strategies.

3. Develop health information standards in all dimensions. Includes standard care mechanisms to provide information systems, coordinate in health data exchange, seamless and secure sharing of data.

4. Implement the legislation, rules relating to the privacy, security, and confidentiality of personal health information, considering the benefits of personal protection and the benefits to society in case of violations of privacy.

5. Develop a systematic mechanism for the Human Resources Development in health information technology systems at the operational level. And adequate management to effectively utilize the health information technology system.

2.2 [7]The developing of the health information technology system of the country.

1. Establishing a work group and a responsible organization by studying the structure and duties of the staff.

    1.1 [8]Pre-feasibility study of Health Information Technology System Development. The Ministry of Public Health conducts consulting services to study and analyze the information needs and connectivity problems of the medical and health information systems.

    1.2 Survey of existing information systems used by the Ministry of Public Health and related agencies.

    1.3 Set policy and strategy for development of health information technology system of the country in order to be a part of the policy framework and ICT Strategy along with other strategy development.

    1.4 Developing health information standards in all their aspects includes some standard care mechanisms. Providing information systems coordinated in health data exchange with a seamless and secure sharing of data in order to achieve a higher quality in public care.

2. Thailand needs a national organization that defines development direction, strategic planning, formulates policy and creates national health information technology system development plans.

    2.1 This National organization should include staff from all agencies involved in the health information technology system, which are the public sector, the state enterprise and private agencies. 2.2 This National organization should be an independent agency which helps to manage all various aspects of the National Health Information Technology System and to streamline it as a public organization (by legislation).

3. This National organization should work with consultants and experts in health information systems by working together on feasibility study, Terms of Reference (TOR), monitoring, implementing, hardware installation, software development, personnel development and other tasks. The results of the pre-feasibility study should be used as a framework for further studies. The feasibility study and TOR should be framed as follows:

    3.1 Set the implementation time frame, including steps, and budget estimates that will be required.

    3.2 Define technical specification for the development in hardware, communication, software and appropriate personnel for Thai health services in primary level, secondary level, tertiary level and higher levels.

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[8] More details in Pornchai Chanyatorn and Faculty of Research. The gap analysis of information needs and information systems of the Ministry of Public Health. Consulting project to study and analyze information needs and connectivity of medical and health information systems, Ministry of Public Health.2014

3.3 Define the theoretical training and on-the-job training courses for staff who will administer the health information system and use the equipment.

4. The National organization must participate in the implement by monitoring the auction companies to meet the requirements.

5. The National organization needs to study and implement the legislation, rules related to privacy, security, and confidentiality of personal health information, considering the benefits of personal protection and the benefits to society in case of violations of privacy.

6. The National organization should work with educational institutions. It must provide support for teaching health information technology and introducing the use of ICT in the curricular of professionals, such as doctors, nurses, pharmacists, etc. It should support by Biomedical and Health Informatic courses for health and public health personnel, computer technology personnel and general students.

2.3 National Context for eHealth Development

Based on the ICT and eHealth environment, the national context can be described in the following way:

- Experimentation and early adoption, where both the ICT and enabling environments are at an early stage
- Developing and building up, where the ICT environment grows at a faster rate than the enabling environment
- Scaling up and mainstreaming, during which the enabling environment matures to support the broader adoption of ICT.

These contexts are explained in a summary at the end (Figure 2.3.1)
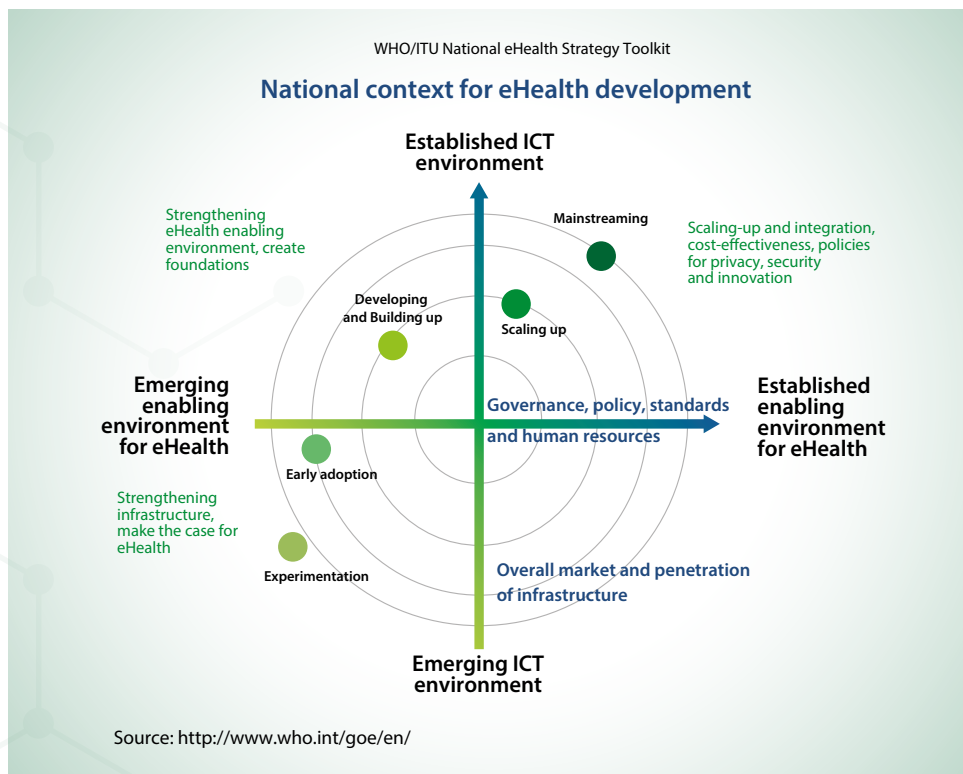
Figure 2.3.1 National Context for eHealth Development

A country's eHealth strategy should be based on national health priorities, the available and potential resources, and the current eHealth environment. A national vision for eHealth also takes shape within a national context that can be considered in terms of two dimensions. The ICT environment (vertical axis) represents the national ICT market and overall penetration of computing and networking infrastructure. The enabling environment for eHealth (horizontal axis) is fundamental to scaling up and sustaining ICT adoption in the health sector. It includes aspects such as governance, policy, legislation, standards and human resources. **The use of ICT in Thailand**

The environment subindex of a country's market and regulatory framework need to support high levels of ICT uptake. The development of entrepreneurship and innovation prone conditions maximise the potential impacts of ICT in boosting competitiveness and wellbeing includes a total of eighteen variables distributed into two pillars. Thailand Networked Readiness Index ranking is 54 (out of 139 countries). Value is 4.2 distance from best.

[9]Singapore leads the report's Networked Readiness Index, followed by Finland, Sweden, Norway and the United States. The[10] top five in the region in terms of overall ICT readiness remain China, Malaysia, Mongolia, Sri Lanka, and Thailand, as in 2015. The group of emerging and developing Asian countries has been both moving up and converging since 2012. Individual usage in the region is still one of the lowest in the world, but has been growing strongly in recent years.

	Rank (out of 139)	Value (1–7)
Networked Readiness Index.....................	**62**	**..4.2**
Networked Readiness Index 2015 (out of 143)	67	4.0
Networked Readiness Index 2014 (out of 148)	67	4.0
Networked Readiness Index 2013 (out of 144)	74	3.9
A. Environment subindex	**54 .....**	**4.2**
1st pillar: Political and regulatory environment	80	3.7
2nd pillar: Business and innovation environment	48	4.6
B. Readiness subindex	**62 ......**	**4.9**
3rd pillar: Infrastructure	67	4.3
4th pillar: Affordability	64	5.5
5th pillar: Skills	73	5.0
C. Usage subindex	**63 .....**	**4.0**
6th pillar: Individual usage	64	4.3
7th pillar: Business usage	51	3.9
8th pillar: Government usage	69	3.8
D. Impact subindex	**65 ......**	**3.7**
9th pillar: Economic impacts	74	3.2
10th pillar: Social impacts	57	4.3
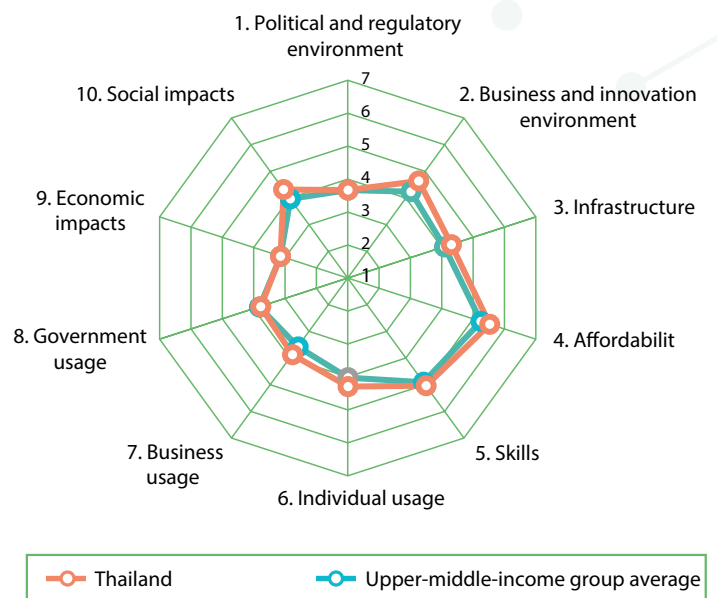
Figure 2.3.2: Thailand Performance Overview

[9] Global Information Technology Report 2016. World Economic Forum. Retrieved from: http://reports.weforum.org/global-information-technology-report-2016/
[10] Silja Baller, Soumitra Dutta, and Bruno Lanvin, editors. The Global Information Technology Report 2016: Executive Summary | xiii

The Networked Readiness Index in details;

INDICATOR	RANK/139	VALUE
1st pillar: Political and regulatory environment		
1.01 Effectiveness of law-making bodies*	93	3.4
1.02 Laws relating to ICTs*	87	3.6
1.03 Judicial independence*	59	4.1
1.04 Efficiency of legal system in settling disputes*	55	3.9
1.05 Efficiency of legal system in challenging regs*	56	3.7
1.06 Intellectual property protection*	113	3.2
1.07 Software piracy rate, % software installed	70	71
1.08 No. procedures to enforce a contract	58	36
1.09 No. days to enforce a contract	42	440
2nd pillar: Business and innovation environment		
2.01 Availability of latest technologies*	70	4.7
2.02 Venture capital availability*	33	3.3
2.03 Total tax rate, % profits	29	27.5
2.04 No. days to start a business	112	28
2.05 No. procedures to start a business	54	6
2.06 Intensity of local competition*	42	5.4
2.07 Tertiary education gross enrollment rate, %	53	51.4
2.08 Quality of management schools*	77	4.0
2.09 Gov't procurement of advanced tech*	90	3.1
3rd pillar: Infrastructure		
3.01 Electricity production, kWh/capita	72	2456.7
3.02 Mobile network coverage, % pop.	97	97.0
3.03 Int'l Internet bandwidth, kb/s per user	48	54.8
3.04 Secure Internet servers/million pop.	81	23.3
4th pillar: Affordability		
4.01 Prepaid mobile cellular tariffs, PPP $/min.	16	0.09
4.02 Fixed broadband Internet tariffs, PPP $/month	89	42.47
4.03 Internet & telephony competition, 0–2 (best)	97	1.63
5th pillar: Skills		
5.01 Quality of education system*	74	3.6
5.02 Quality of math & science education*	79	3.9
5.03 Secondary education gross enrollment rate, %	82	86.2
5.04 Adult literacy rate, %	39	96.7

INDICATOR	RANK/139	VALUE
6th pillar: Individual usage		
6.01 Mobile phone subscriptions/100 pop.	30	144.4
6.02 Individuals using Internet, %	93	34.9
6.03 Households w/ personal computer, %	83	33.9
6.04 Households w/ Internet access, %	80	33.8
6.05 Fixed broadband Internet subs/100 pop.	73	8.5
6.06 Mobile broadband subs/100 pop.	23	79.9
6.07 Use of virtual social networks*	13	6.3
7th pillar: Business usage		
7.01 Firm-level technology absorption*	53	4.9
7.02 Capacity for innovation*	54	4.1
7.03 PCT patents, applications/million pop.	69	1.3
7.04 ICT use for business-to-business transactions*	52	5.0
7.05 Business-to-consumer Internet use*	39	5.1
7.06 Extent of staff training*	41	4.3
8th pillar: Government usage		
8.01 Importance of ICTs to gov't vision*	72	3.9
8.02 Government Online Service Index, 0–1 (best)	73	0.44
8.03 Gov't success in ICT promotion*	85	3.8
9th pillar: Economic impacts		
9.01 Impact of ICTs on business models*	42	4.8
9.02 ICT PCT patents, applications/million pop.	75	0.2
9.03 Impact of ICTs on organizational models*	50	4.4
9.04 Knowledge-intensive jobs, % workforce	90	13.8
10th pillar: Social impacts		
10.01 Impact of ICTs on access to basic services*	55	4.4
10.02 Internet access in schools*	54	4.6
10.03 ICT use & gov't efficiency*	70	4.0
10.04 E-Participation Index, 0–1 (best)	54	0.55

Note: Indicators followed by an asterisk (*) are measured on a 1-to-7 (best) scale.

2.4 The current status of Thailand's eHealth and the nation's direction of eHealth development.

Table 1 : Summary of eHealth uptake in Thailand

Table 1 Summary of eHealth uptake in Thailand	Uptake
I. Foundation Policies & Strategies	
1. National eGovernment policy & strategy	√ Thailand 4.0, Digital Thailand
2. National eHealth policy & strategy	X
3. National eHealth governance body	X
4. Funding	+ Public, No Private
5. Public & Private partnership	+
6. Infrastructure	++
II. Enabling Policies & Strategies	
1. Health information security & privacy laws	X
2. Actions on Multilingualism & Multiculturalism	++
3. Capacity building	+++
3.1. IT courses for health science students	+
3.2. IT courses for health professional	+
4. National health IT standards (Interoperability)	12 & 18 files standards
4.1. Core data set standards	ICD 10 TM, ICD 9 CM
4.2. Semantic standards	X
4.3. Syntactic standards	X
III. eHealth Applications	
1. mHealth	++, mostly pilot
2. Telemedicine	+, pilot
3. eLearning in health sciences	+
4. EHR/EMR (Health Information Exchange)	++
4.1 For administration, claims	+++
4.2 For clinical care	+
Note: √ = Adopted, X = No uptake, + =0-25% uptake, ++ = 26-50% uptake, +++ = 51-75% uptake, ++++ = 76-100% uptake, ICT 2010 = Thailand ICT development frame work 2000-2010, ICD 10 TM = International Classification of Disease version 10 Thai Modification, ICD 9 CM = ICD9 Clinical Modification procedure codes.	

2.5 [11]ICT foundations Readiness Assessment of The Permanent Secretary Ministry of Public Health

The readiness sub index, with a total of 12 variables, measures the degree to which The Office of The Permanent Secretary Ministry of Public Health is prepared to make good use of an affordable ICT infrastructure, hardware, software & information system and ICT workforce. The average score of the ICT Readiness Assessment was 3.60. The findings revealed that The Office of The Permanent Secretary Ministry of Public Health should consider on ICT Infrastructure and ICT Hardware. There is real value in drawing lessons from experience about how to successfully implement policies, and in using those insights to strengthen performance in the future. This knowledge is crucial for the success of ehealth strategies development and implementation.

The survey of health IT (hardware, software, network, peopleware) from 12,380 hospitals & health stations in Thailand can also see from http://ictapp.moph.go.th/project/survey/s_basic.php .The percentage response rate for this survey is 57.54.

The analysis of MoPH Infrastructure can be devided in to 4 factors: ICT hardware, software system, information system, and peopleware as in Figure 2.5 showing scores, results of assessment, readiness in information technology and communication.

ICT Readiness Score

(ICT Infrastructure, I)

3.25

4.63
(People,P)

2.75
(ICT Hardware, H)

3.78

(Software & information system,S)
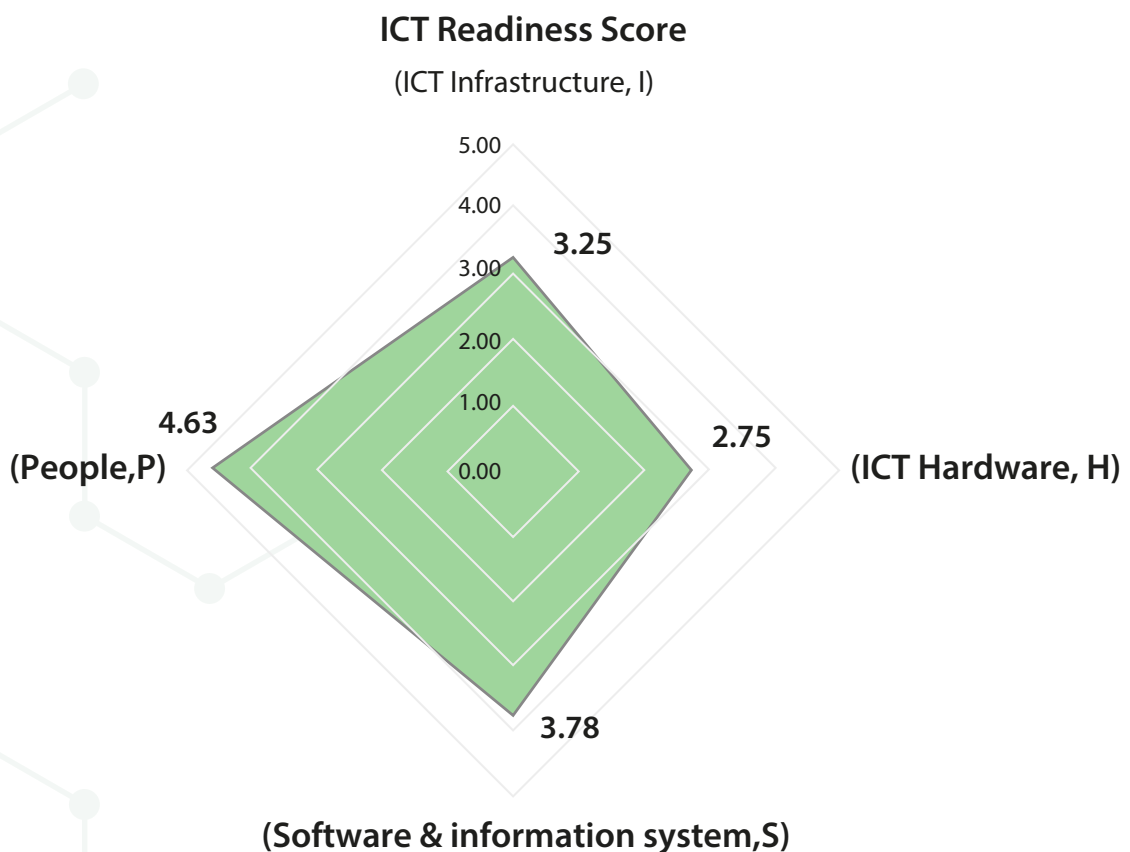
Figure 2.5 Chart showing scores, results of assessment, readiness in information technology and communication

[11] More details in Pornchai Chanyatorn and Faculty of Research. The gap analysis of information needs and information systems of The Ministry of Public Health. Consulting project to study and analyze information needs and connectivity of medical and health information systems, Ministry of Public Health.2014

1. ICT Infrastructure

Infrastructure of information technology consists of 3 factors: network, electrical system and physical structure. The average score is 3.25 in ICT Infrastructure. There are a clear infrastructure policy and potential for continuous improvement. Electric power system scored 2.5 because of the lack of policy on energy saving and safeness of the power system.

2. ICT hardware

The IT equipment or hardware factor consists of two factors: clients and servers. This factor scored 2.75. Clients within the Office of the Permanent Secretary for Public Health are 3-5 years old. Computer features and performance are adequate and responsive. The development plan of server is unclear as to the maintenance or upgrade plan in software for server.

3. The software and information system

The software and information system consist of three sub-factors: software, task system and core information system.

Software operating systems, and supporting information systems, service and issues, documentation and security Information system, scored 3.78. There is a clear management plan of software and information systems in terms of security, but there is a lack of detail in the implementation phase. Standard Operating Procedures (SOP) should be clarified for practical implementation.

4. People

ICT personnel consists of two factors: investment on people and knowledge management. This scored 4.63 base on information, the development of personnel, regular training, as well as the development of knowledge management system. Staff must be encouraged to take the specific certification exam, such as Networking Operating Management System. This will empower the staff with the ability to learn and improve faster than competitors.

Table 2-5 ICT Readiness Assessment of The Permanent Secretary Ministry of Public Health

The current status of IT use in Thai healthcare according to the ICT Readiness Assessment of The Office of The Permanent Secretary Ministry of Public Health are summarized as follows:

ICT Readiness Assessment	$\bar{X}$	Summary (Total score = 5)
ICT Infrastructure		
Network	3.42	
Electric and power	2.50	3.25
Physical structure	3.83	
ICT Hardware		
Clients	2.50	2.75
Servers	3.00	
Software & information system		
Main software applications and information systems	4.25	
Software Support and information systems Support	3.00	
Services and issues	4.00	3.78
Documentation	4.00	
Information security	3.6	
People		
Investment on people	4.75	4.63
Knowledge management	4.50	
Total score		**3.60**

Chapter 3 : Environmental Analysis of the eHealth Sector in Thailand

Editorial board

3.1 eHealth components (WHO, National context for eHealth)

The national eHealth environment is made up of components, or building blocks (Figure 3.1), which will be introduced or strengthened through the eHealth strategy.
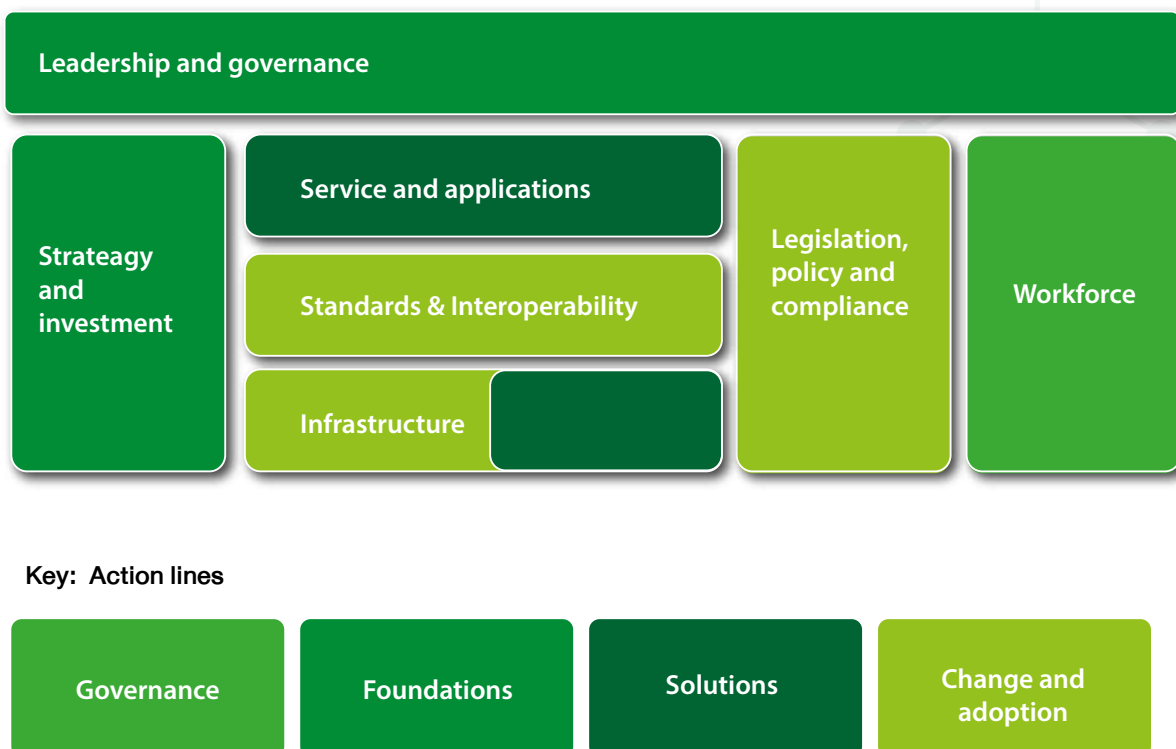
Figure 3.1 eHealth components

The components can be grouped into the ICT environment and the enabling environment. Role of eHealth components can be described as follows:

1. Leadership, governance and multi-sector engagement

- Direct and coordinate eHealth at the national level; ensure alignment with health goals and political support; promote awareness and engage stakeholders.

- Use mechanisms, expertise, coordination and partnerships to develop or adopt eHealth components (e.g. standards).

- Support and empower required change, implementation of recommendations and monitoring results for delivery of expected benefits.

2. Strategy and Investment

- Ensure a responsive strategy and plan for the national eHealth environment. Lead planning, with involvement of major stakeholders and sectors.

- Align financing with priorities; donor, government and privatesector funding identified for medium term

3. Services and Applications

- Provide tangible means for enabling services and systems; access to, and exchange and management of information and content. Users include the general public, patients, providers, insurance, and others. The means may be supplied by government or commercially.

4. Standards and Interoperability

- Introduce standards that enable consistent and accurate collection and exchange of health information across health systems and services.

5. Infrastructure

- Form the foundations for electronic information exchange across geographical and health-sector boundaries. This includes the physical infrastructure (e.g. networks), core services and applications that underpin a national eHealth environment.

6. Legislation, Policy and Compliance

- Adopt national policies and legislation in priority areas; review sectoral policies for alignment and comprehensiveness; establish regular policy reviews.

- Create a legal and enforcement environment to establish trust and protection for consumers and industry in eHealth practice and systems.

7. Workforce

- Make eHealth knowledge and skills available through internal expertise, technical cooperation or the private sector.

- Build national, regional and specialized networks for eHealth implementation.

- Establish eHealth education and training programmes for health workforce capacity building.

3.2 eHealth environment in Thailand and the development of eHealth foundations

Table 3-2 eHealth environment in Thailand and the development of eHealth foundations[12]

Country Indicators					
Population (000s)	67386	Total health expenditure (%GDP)	4.0	ICT Development Index	3.27
GNI per capita (PPP Int $)	7640	Per capita total health expenditure (PPP Int $)	323	ICT (ICT Development Index rank)	76
World Bank income group	Lower-middle	Hospital bed density (per 10 000 population)	22	Mobile cellular subscriptions (per 100 population)	97.33
OECD country	No	Physician density (per 10000 population)	3.1	Internet users (per 100 population)	25.80
Life expectancy at birth (years)	70	Nurse density (per 10 000 population)	13.6	Disability Adjusted Life Years (DALY)	20216

1. eHealth foundation actions

eHealth foundation actions build an enabling environment for the use of ICT for health. These include supportive eHealth policy, legal and ethical frameworks; adequate funding from various sources; infrastructure development; and developing the capacity of the health work force through training.

I. Policy framework

	Country response	Global response (%)§[13]	Policy implemented	Year of implementation
National eGovernment policy	Yes	85b[14]	Yes	2002
National eHealth policy	No	55 b	–	–
National ICT procurement policy for health sector	No	37 b	–	–
National multiculturalism policy for eHealth	No	30 c	–	–
National telemedicine policy	No	25	–	–

II Legal and ethical frameworks for eHealth

	Country response	Global response (%)a§
Legislation on personal and health-related data	Yes	70
To ensure privacy of personally identifiable data	No	31
To protect personally identifiable data specifically in EMR or EHR [1]	No	26

	Country response	Global response (%)[a§]
Legislation for sharing health-related data between healthcare staff through EMR/EHR 1		
Within the same health care facility and its network of care providers	No	23
With different health care entities within the country	No	11
Internet pharmacies		
Legislation that allows/prohibits Internet pharmacy operations	No	Allows: 7, Prohibits: 19
National regulation/accreditation/ certification of Internet pharmacy sites	No	7
Legislation that allows/prohibits Internet pharmacy purchases from other countries	No	Allows: 6, Prohibits: 12
Internet safety		
Government sponsored initiatives about Internet safety and literacy	Yes	47
Security tools required by law for facilities used by children	No	22
Quality assurance approaches to health-related Internet content		
Voluntary compliance by content providers or web site owners	Yes	56
Technology through filters and controls	Yes	28
Government intervention through laws or regulations	No	26
Education programmed for consumers and professionals	Yes	23
Official approval through certification, accreditation, or quality seals	No	17

III. eHealth expenditures and their funding source

Expenditure	Public funding		Private funding		Donor/non-public funding		partnerships fund	
	Country response	Global response (%)[b§]	Country response	Global response (%)[b§]	Country response	Global response (%)[b§]	Country response	Global response (%)[b§]
ICT equipment	Yes	78	–	37	Yes	59	Yes	28
Software	Yes	76	–	35	Yes	56	Yes	29
Pilot projects	Yes	69	–	33	Yes	51	Yes	28
Ongoing support	Yes	61	–	19	Yes	35	Yes	18
Scholarships	Yes	28	–	8	Yes	19	Yes	4

IV. Capacity building

	Country response	Global response (%)[b§]
ICT education		
ICT training for students in health sciences at tertiary institutions	Yes	77
Institutions offer continuing education in ICT for health professionals	Yes	75
Professional groups offered ICT continuing education		
Medical	Yes	73
Nursing	Yes	62
Public health	Yes	60
Dentistry	Yes	54
Pharmacy	Yes	54

eHealth Strategy, Ministry of Public Health (2017– 2026)

2. eHealth applications

eHealth applications surveyed in 2009 include telemedicine (the delivery of health care services using ICT where distance is a barrier to care); mHealth (the use of mobile devices in delivering health care services); and eLearning (use of ICT for learning).

I. Telemedicine		
	Country response	Global response(%)[c§]
Telemedicine enabling actions		
Within the same health care facility and its network of care providers	No	25
Implemented national telemedicine policy	–	–
Formal evaluation and/or publication of telemedicine initiatives since 2006	No	22
Barriers to implementing telemedicine solutions		
Perceived costs too high	Yes	60
Lack of legal policies/regulation	No	40
Organizational culture not supportive	No	39
Underdeveloped infrastructure	Yes	38
Lack of policy frameworks	Yes	37
Competing priorities	No	37
Lack of demand by health professional	Yes	31
Lack of nationally adopted standards	Yes	26
Lack of knowledge of applications	No	25
Lack of technical expertise	No	17
Information most needed in country to support telemedicine development		
Cost and cost effectiveness	Yes	69
Clinical possibilities	Yes	58
Infrastructure	Yes	52
Evaluation	Yes	46
Legal and ethical	No	45
Effect on human resources	No	40
Patients' perception	No	30

II. mHealth

	Country response	Global response(%)[b§]
mHealth initiatives		
mHealth initiatives are conducted in country	Yes	83
Formal evaluation and/or publication of mHealth initiatives	No	12
Barriers to implementing mHealth initiatives		
Competing priorities	No	53
Lack of knowledge of applications	Yes	47
Lack of policy framework	Yes	44
Cost effectiveness unknown	Yes	40
Lack of legal policies/regulation	No	38
Perceived costs too high	No	37
Lack of demand	No	29
Underdeveloped infrastructure	No	26
Lack of technical expertise	Yes	26

IIIa. eLearning

	Country response	Global response(%)[b§]
eLearning in health sciences at the tertiary level		
Used in teaching health sciences	Yes	72
Used in training health professionals	Yes	69
Barriers to eLearning		
Underdeveloped infrastructure	No	64
Lack of policy framework	Yes	63
Lack of skilled course developers	Yes	55
Lack of knowledge of applications	Yes	46
Perceived costs too high	No	45
Availability of suitable courses	No	42
Lack of demand	Yes	21

IIIb. eLearning target groups

Expenditure	Public funding		Private funding	
	Country response	Global response %)[c§]	Country response	Global response (%)[b§]
Medical	Yes	68	–	71
Public health	Yes	52	–	56
Nursing	Yes	50	–	37
Pharmacy	Yes	45	–	37
Dentistry	Yes	39	–	37

[a] n=113   § Indicates the percentage of participating Member States responding "Yes" 1 Electronic medical records / Electronic
[b] n=112
[c] n=114

eHealth Strategy, Ministry of Public Health (2017– 2026)

Chapter 4 : eHealth strategic concept

Editorial board

eHealth strategies are primarily developed to deliver health benefits for the country, they can also be an important mechanism for facilitating cooperation at the regional level and driving investment in ICT infrastructure, research and development. The operational framework is a strategic setting that will help the country achieve its vision of universal health care.

The World Health Organization's eHealth Strategic Guidelines are shown in the following table.

Table 4-1 The framework on eHeath and Action lines

Action line	Example characteristics
Governance	• Provides coordination, visibility and oversight of the eHealth action plan (i.e. programme activities). • Develops governance structures and mechanisms to ensure accountability, transparency and ffective leadership is in place.
Foundations	• Deliver eHealth components that support secure electronic information exchange across a country's geographical and health-sector boundaries, or improve access to health-care services through electronic channels. • Are of national significance, and too risky or complex to eliver successfully if approached by other means than by a national, coordinated approach. • Are more cost effective to develop only once at a ational level rather than duplicating effort and expenditure across states, regions, and private sector.
Solutions	• Encourage the development and use of high-priority eHealth services and applications to improve the efficiency and effectiveness of health system management and care delivery. • Deliver eHealth components that enable individuals, ealth-care providers and health-care managers to access, view, use and share health information as part of care provision. • Deliver eHealth components that provide the tangible means by which stakeholders will benefit from the national eHealth environment. • Deliver eHealth components that access, interact with nd use national foundations and nfrastructure to access and share information.

Action line	Example characteristics
Change and adoption	• Motivate, prepare and support the health system in adopting and using eHealth in health-care management and delivery. • Establish incentives, facilitate the adoption of eHealth services and applications, and change work practices to be able to use eHealth effectively.

Implementing the eHealth vision is associated with a large number of coordinated projects. The eHealth structure must be managed effectively. The World Health Organization (WHO) has divided eHealth into four groups of 21 projects. Each group has its own program and is managed by a subset of programs. The details of eHealth Program of work & eHealth strategy capabilities are listed below.

eHealth Program of work

		eHealth Strategy Capabilites			
		Intergrated and comprehensive patient information	Consolidated information to support decission making	Optimising scheduling around patient need	Supporting delivery location independent health services
Portfolio 1: Information Intergration and Communication	Enterprise Information Repository	✓	✓	✓	✓
	Systemms Integration	✓	✓	✓	✓
	User Potals	✓	✓	✓	✓
	Information Communications	✓		✓	✓
Portfolio 2: Core Systems Implementation	Medications Reporting	✓	✓		✓
	Emergency Information Management	✓	✓	✓	✓
	Diagnostic Imaging	✓	✓	✓	✓
	Community Health and Mental Health	✓	✓	✓	✓
	Patient Management and Coodination	✓	✓	✓	✓
	Analysis and Reporting	✓	✓	✓	✓
	Clinical Management	✓	✓	✓	✓
Portfolio 3: Foundation projects	Information Management	✓	✓	✓	✓
	Unique Patient Identifier	✓		✓	✓
	Unique Provider Identifier and Services Catalogue		✓	✓	✓

Table 4 - 2 eHealth Program of work & eHealth strategy capabilities
(Source : WHO & ITU. National eHealth Strategy Toolkit)

The details in the table above provide an overview of the purpose and scope of the key activities for eHealth implementation by all organizations. They can assess eHealth's strategic ability to drive eHealth in such a framework. This will be a useful basis for the selection of eHealth operations strategies. It will summarize the following operational steps:

- Define strategy – Analyze options for strategic development to present project initiatives.
- Review / assess existing capabilities and consider how these boundaries can be leveraged or applied to internal activities.
- Selection – Specification of requirements and choose the right solution through the procurement process in the relevant section.
- Design & Build – involves designing, creating, testing and debugging.
- Execution – involves deploying a solution in a user's operating environment and training, using and problem solving.

Part	Term	Definition
Part I: Establishing a national eHealth vision	Strategic goals and challenges	Strategic health sector goals and challenges and/or other national development goals that can be best supported by eHealth. While there may be many different health sector goals and challenges, only some of these can be directly supported by eHealth and where a national eHealth vision will have the most impact.
	eHealth outcomes	What will be achieved or changed through using eHealth, and how will the health system and services change by: • Improving the information flows within the health sector • Improving electronic access to health services and information.
	eHealth vision	High-level statement that describes the strategic benefits and outcomes for the country in general or for the health system and population through the strategic changes to health system and services introduced by eHealth (eHealth outcomes).
	National eHealth environment	The national eHealth environment is made up of eHealth components representing the enabling and foundation elements for eHealth as well as technical capabilities that form together an 'ecosystem' for eHealth in a country.
	eHealth components	The building blocks of a national eHealth environment, which will allow the eHealth outcomes to be achieved. They describe what is needed to be introduced or strengthened to achieve the eHealth vision in terms of: • leadership and governance • strategy and investment • services and applications • infrastructure • standards and interoperability • legislation, policy and compliance • workforce
	Strategic recommendations	Strategic recommendations describe the high–level actions required to deliver the national eHealth environment. These actions may describe how new eHealth components will be delivered, or how existing eHealth components will be repurposed or extended

Part	Term	Definition
Part II: Developing an eHealth action plan	Action Lines	Broad areas to group national activities of similar focus and intent that are required to deliver a nation's eHealth vision
	eHealth Outputs	The specific achievements, deliverables, results or changes required to deliver a strategic recommendation
	Activities	The set of activities that need to be undertaken to deliver a particular output
Part III: National eHealth monitoring and evaluation guidelines	Output indicators	Indicators that provide insights into the adoption and take-up of eHealth within the country's health sector
	Outcome indicators Indicators	Indicators that provide insights into the tangible results for stakeholders that arise from the adoption and use of eHealth

Table 4-3 Parts of eHealth and Terms (National eHealth Strategy)
(Source : National eHealth Strategy Toolkit 2013, P88)

Parts of eHealth and Terms

According to the table above (Figure 4-2 Parts of eHealth and Terms) National eHealth Strategy can be divided into 3 parts:

Part I **:** establishing a national eHealth vision which includes: strategic goals and challenges, eHealth outcomes, eHealth vision, National eHealth environment, eHealth components and Strategic recommendations.

Part 2 **:** developing an eHealth action plan

Part 3 **:** national eHealth monitoring and evaluation guidelines.

This document is Part 1, which will lead to the implementation of Part 2 and 3.

From all above, the eHealth committee synthesized eHealth components in Thailand and sought assistance from WHO to develop an eHealth strategy that explores how information can support the organization in responding to these strategic and operational challenges. eHealth planning principles are drawn from the following:

• Situation analysis of public health problems.
• The 20-year National Strategy.
• Strategies and goals of the National Health Development Plan No. 12.
• SWOT analysis of the ICT Health, based on eHealth elements.
• Analyze the eHealth environment in Thailand.
• Strategic development of health information systems of the year 2013 to 2019.
• National Health Information Framework for ICT 2020 prepared by the Ministry of Information and Communication.
• ICT 2020.
• ASEAN ICT Master Plan.
• e-Government.
• Digital economy.
• Regional Strategy for Strengthening eHealth in South-East Asia Region 2015 – 2021.

SWOT analysis based on eHealth components and the synergy of ICT and eHealth strategies are found to be consistent. This can be summarized as a strategy for the development of eHealth of the country into 6 strategies. The eHealth working group brainstormed and came to the conclusions that the eHealth Strategy must be as follows.

eHealth Strategy

VISION

A strong, equal and efficient eHealth strategy to improve the quality of life for Thai citizens by 2020.

MISSION

1. Develop IT Management System for effective eHealth operations of the Country.
2. Partnership, coordination and participation to enhance the use of eHealth in order to improve the quality of life for people.

GOAL

1. Improve quality of life through inclusive access to eHealth services sustainably.
2. Local communities and networking partners benefit from the eHealth system so that they can lead the development of people's quality of life.

eHealth Strategy Framework

1

Strategy 1:
Establish a central organization for eHealth management and cooperation.

Tactic 1	Enhance the federal statutes for eHealth cooperation and management.
Tactic 2	Formulate eHealth implementation policy, equal support to the administrative and service units.
Tactic 3	Support the implementation, coordination and cooperation in eHealth development.
Tactic 4	Participate in monitoring and evaluation of the Implementation.

2

Strategy 2:
Develop and improve enterprise architecture and infrastructure which are readily available to support eHealth services to the public.

Tactic 1	Engage with stakeholders in order to develop an eHealth Enterprise Architecture to support all aspects of national health strategies.
Tactic 2	Develop Infrastructure Services by consideration of user requirements in 4 groups: executives, healthcare staffs, people and other agencies to operate inside Thailand and abroad.
Tactic 3	Provide Infrastructure services for people to access and get Individual Health Information.
Tactic 4	Promote the use of Infrastructure management which related to effective data network management, cost-effective & secure, and determine percentage of bandwidth utilization.

3

Strategy 3:
Establish standards of Health Information System, effective data integration and interoperability.

Tactic 1	Establish health information standards required for data-sharing to achieve effective interoperability.
Tactic 2	Develop a National Health Data Warehouse.
Tactic 3	Develop Health Information Security Standards.
Tactic 4	Develop monitor indicators for health system efficiency.
Tactic 5	Develop a surveillance - tracking and forecasting health system.

eHealth Strategy

eHealth Strategy Framework

4

Strategy 4:
Promote and develop eHealth innovation, services and applications which provide benefits to health care delivery system and patients, consumer protection including licensing regimes.

Tactic 1   Increase the efficiency of ICT management and propel for eHealth in Software, Hardware, and Peopleware.

Tactic 2   Adopt legislation, provision, rules, regulations, criteria and compliance to establish trust and protection for consumers, health personnel and industry in eHealth practice and systems.

5

Strategy 5:
Establish Laws, regulations, compliances and standards of ICT in Healthcare System.

Tactic 1   Create a legal environment and eHealth law enforcement to achieve a comprehensive, and promulgating a policy.

Tactic 2   Adopt legislation, provision, rules, regulations, criteria and compliance to establish trust and protection for consumers, health personnel and industry in eHealth practice and systems.

Tactic 3   Review and develop eHealth standards to enable consistency and accuracy in Health care services.

6

Strategy 6:
Develop Human Capital in eHealth and ICT Knowledge Management in medical and healthcare for citizens.

Tactic 1   Create the eHealth Human Resource Management System (HRM)

Tactic 2   Enhance the eHealth Human Resource Development (HRD)

Tactic 3   Promote networking between developers and/or users including the private sectors involved in eHealth.

Tactic 4   Support education and knowledge in public sector

- standards and interoperability Healthcare Logistics
- Legislation of Health Information Exchange
- National Health Information System development/ Drug Information
- Personal health records (PHRs) development (MoPH coordinated with the Ministry of Interior)
- Health surveillance system / Emergency Medical Systems
- mHealth/teleHealth to support Family doctor And people in remote areas.
- eHealth (HRD and HRM)

THE SIX BUILDING BLOCKS OF A HEALTH SYSTEM
SERVICE DELIVERY, HEALTH WORKFORCE, HEALTH INFORMATION SYSTEMS,
ACCESS TO ESSENTIAL MEDICINES, FINANCING, LEADERSHIP / GOVERNANCE

Strategy 1: Establish a central organization for eHealth management and cooperation

Goals	KPIs	Strategic goals	Tactics	Flagship	Principle person
1. Establishing a central organization in which eHealth will be driven the management and public health services effectively.	1. Levels of success in establishing a central organization for layout policy formulation and supervise eHealth implementations (National Level, Ministry Level, Region Level and Provincial Level).	Central organization affirm and support our mission of operating also driving eHealth, coordinating and engaging all health sector actors to develop or adopt eHealth components effectively.	**Tactic 1** Enhance the federal statutes for eHealth cooperation and management. • The draft bill of ACT for establish a central organization of eHealth management cooperation.	1. Establish a professional organization for building consensus on policy and supervise on eHealth operations within 1 year.	Ministry of Public Health and all departments. Region Health Provider Ministry of ICT Ministry of Justice Ministry of Interior and the associated Ministry.
			Tactic 2 Formulate eHealth implementation policy, equal support to the administrative and service units. 1. Formulat eHealth structure in all level (national, regional, and provincial Level) which required to support eHealth operations (within 1 year). 2. Targeted eHealth operations in line with public health management in the context of health area. 3. Determine management guidelines according to eHealth Strategy Toolkit of WHO & ITU (Leadership, Governance, Strategy, Investment).		Ministry of Public Health and all Departments. Region Health Provider Ministry of ICT Ministry of Justice Ministry of Interior and the associated Ministry.
			4. Define indicators for participatory monitoring and evaluation 5. Supports all levels of eHealth's organization to work out implementation plans for personnel, budgets, ICT infrastructure, and eHealth management.		Ministry of Public Health and all Departments. Region Health Provider Ministry of ICT Ministry of Justice Ministry of Interior and the associated Ministry.

Strategy 1: Establish a central organization for eHealth management and cooperation (continued)

Goals	KPIs	Strategic goals	Tactics	Flagship	Principle person
2. Creating collaboration and partnership development with other sectors at all levels to propel eHealth.	Number of collaborative partners to propel eHealth.	Get cooperation to propel eHealth from all sectors effectively.	**Tactic 3** Support the implementation, coordination and cooperation in eHealth development. 1. Support the coordination in eHealth development by the cooperation meeting between agencies and relevant sectors such as collaboration in health services between Public and Private Partnership – PPPs, and academic teaching cooperation.	2. Collaborative networking meeting, determine cooperation in eHealth operations, follow Key Flagship in each strategy.	Ministry of Public Health and all Departments. Region Health Provider Ministry of ICT Ministry of Justice Ministry of Interior and the associated Ministry.
			2. Partnerships must be initiated and maintained to ensure effective and continuous implementation of the eHealth Plan for promoting citizen's quality of life, by equality, fair and sustainable in accessing to health services. 3. Corresponding agencies must be established the cooperation in PHRs and living statistics interoperation. 4. Promote appropriate laws and regulations to support the use of eHealth in the health system. **Tactic 4** Participate in monitoring and evaluation of the implementation.		Ministry of Public Health and all Departments. Region Health Provider Ministry of ICT Ministry of Justice Ministry of Interior and the associated Ministry.

Strategy 2: Develop and improve enterprise architecture and infrastructure which are readily available to support eHealth services to the public.

Goals	KPIs	Strategic goals	Tactics	Flagship	Principle person
1. The Enterprise Architecture (EA) element provides for team collaboration and cross functional sharing of eHealth.	1. The development of eHealth Enterprise Architecture has been accepted from all involved sectors within 1 year.	The Enterprise Architecture (EA) function will provide a design, support and validation service, based on International Standards and best practices. It will provide a consistent approach for defining, architecting and communicating the eHealth architectural viewpoints, technology components, and processes needed to deliver on eHealth mandate and facilitate eHealth operations.	**Tactic 1** Engage with stakeholders in order to develop an eHealth Enterprise Architecture to support all aspects of national health strategies.	1. Knowledge Building Program in Enterprise Architecture (EA) to support Thai health agencies. 2. Enterprise Architecture Project for eHealth	Ministry of Public Health and all Departments. Region Health Provider Ministry of ICT Ministry of Justice Ministry of Interior and the associated Ministry.
2. Provide architectural views that help communicate the complexity of large eHealth systems and facilitate the management of an extensive and complex eHealth environments. Provide standardisation and focus on the strategic use of emerging technologies to better manage information assets and consistently insert appropriate standards conformant technologies into eHealth enterprise.	1. The number of service units that the infrastructure can served to the user- group. 2. The amount of eHealth traffic in each channel.		**Tactic 2** Develop Infrastructure Services by consideration of user requirements in 4 groups: executives, healthcare staffs, people and other agencies to operate inside Thailand and abroad.		

Strategy 2: Develop and improve enterprise architecture and infrastructure which are readily available to support eHealth services to the public. (continued)

Goals	KPIs	Strategic goals	Tactics	Flagship	Principle person
3. Digital Infrastructure Optimization by using the right technology within 5 years.	1. To provide and design appropriate technology to support the Individual Health Information service of M2 hospital within 3 years. 2. A list of individual health information available for recording data to people at least 3 subscribers within 3 years. 3. Health Service Provider can record and use Individual Health Information at least 30% of M2 hospitals *		**Tactic 3** Provide Infrastructure services for people to access and get Individual Health Information.	1. Appropriate Technology Education Project to support Individual Health Information services within 5 Years	Ministry of Public Health and all Departments. Region Health Provider Ministry of ICT Ministry of Justice Ministry of Interior and the associated Ministry.
4. Optimize and secure the quality of infrastructure management which are related to the data network.			**Tactic 4** Promote the use of infrastructure management which is related to effective data network management, cost-effective & secure, and determine percentage of bandwidth utilization.	1. Safety standards for infrastructure and the average monthly data usage required to meet a certain amount. 2. Renovate and modificate Infrastructural technology that can pass the safety standards and a fault-tolerant system requiring specific speed.	Ministry of Public Health and all Departments. Region Health Provider Ministry of ICT Ministry of Justice Ministry of Interior and the associated Ministry.

*M2 hospital means 120 beds up of community hospitals with 3 or 5 family physicians or family physicians, and 6 specialized physicians (Medicine, Surgery, Gynecology, Pediatrics, Orthopedics, Anesthesia) At least 2 specialists in inpatient, operating room, maternity ward, intensive care unit, Diagnostic laboratory for Specialist medical treatment, Diagnostic radiology for 6 specialized specialists. Supports transfer from other community hospitals and reduce the transmission to the general hospital. And support the primary care network of each district.

Strategy 3: Establish standards of Health Information System, effective data integration and interoperability.

Goals	KPIs	Strategic goals	Tactics	Flagship	Principle person
1. Capacity building and system compatibility for integrating a diverse health information system. The elements of an array data structure are required to have the same standard for data exchange and interoperability to support health and macroeconomics of information.		1. To improve and adopt effective health data standards for data exchange and interoperability.	**Tactic 1** Establish health information standards required for data-sharing to achieve effective interoperability. • Create a Health Data Structure Standard, Data Presentation Standard, Data Items and Data Value Standards, as well as measurement unit and key criteria.	Emerging Individual Health Information Standards **Year 1:** Announced as a standard for public health agencies under the Ministry of Public Health. **Year 3:** 100% of public health agencies under the Ministry of Public Health use standardized data sets. **Year 5:** Release announcement of standard data set for public health agencies of the country.	Bureau of Policy and Strategy, ICT Center, Ministry of Public Health and all Departments. Region Health Provider Ministry of ICT Ministry of Justice Ministry of Interior and the associated Ministry.
			2. Data Interchange Standards in Healthcare IT • Computable Interoperability	Emerging Safety Standards for health information exchange **Year 1:** Announced as a standard for public health agencies under the Ministry of Public Health. **Year 3:** 100% of public health agencies under the Ministry of Public Health use health information exchange tools as required. **Year 5:** Release announcement of healthcare information exchange standard for public health authorities of the country.	ICT Center, Bureau of Policy and Strategy, Ministry of Public Health and all Departments. Region Health Provider Ministry of ICT Ministry of Justice Ministry of Interior and the associated Ministry.
			3. Establish health information standards required for data-sharing to achieve effective interoperability in all public health settings.		ICT Center, Bureau of Policy and Strategy, Ministry of Public Health and all Departments. Region Health Provider Ministry of ICT Ministry of Justice Ministry of Interior and the associated Ministry.

Strategy 3: Establish standards of Health Information System, effective data integration and interoperability. (continued)

Goals	KPIs	Strategic goals	Tactics	Flagship	Principle person
2. Reduce duplication of the data management at the provincial and central level. (By collecting and managing data from various sources with redundancy and different to a single system. Comprehensive, accessible and convenient sharing, data-security concerns)	Develop health data warehouse and safety standard format for the provincial health information exchange (Include information from public health agencies under the Ministry of Public Health) by 2017.	1. Developing health data warehouse and safety standard format.	**Tactic 2** Develop a National Health Data Warehouse. 1. Develop a National Health Data Warehouse and standards of Health Information Exchange for quality and safety management. • Define the management model of data management in the health services system, in which applicable for agencies at each level. (Big Data Management in Healthcare System). • Develop a seamless referral system that enables the seamless transfer of patient information (both general and urgent referrals) between service-providers at all levels, wherein patient can easily get services. • Pharmaceutical supply and logistic information systems strengthening • Develop personal health information system (PHR). This is the principle underlying the memorandum of understanding (MOU) that will be signed with Ministry of the Interior.	Standardization of Health Data Warehouse to make the secure, sustainable exchange of health information. **Year 1:** provincial level (Data collected through public health agencies under the Ministry of Public Health) **Year 3:** Health area level (Data collected of all public health agencies) **Year 5:** Ministry level (Data collected of all public health agencies and Private sector) 10 years: National Data Warehouse.	Bureau of Policy and Strategy, ICT Center, Ministry of Public Health and all Departments. Region Health Provider Ministry of ICT Ministry of Justice Ministry of Interior and the associated Ministry.
			Tactic 3. Develop Health Information Security Standards.		Bureau of Policy and Strategy, ICT Center, Ministry of Public Health and all Departments. Region Health Provider Ministry of ICT Ministry of Justice Ministry of Interior and the associated Ministry.

Strategy 3: Establish standards of Health Information System, effective data integration and interoperability. (continued)

Goals	KPIs	Strategic goals	Tactics	Flagship	Principle person
			Tactic 4 Develop monitor indicators for health system efficiency. 1. Develop health indicators and health monitoring systems such as chronic disease monitoring systems, disease surveillance systems and mental illnesses surveillance systems. 2. Develop presentation tools to deliver more powerful presentations including GIS, diagrams. Which can be presented on the internet as a public management tool that can be used to track and demonstrate in order to monitor, evaluate, and utilize the information for the benefit of services and create the development plan.	1. Develop health indicators and monitoring systems.	Bureau of Policy and Strategy, ICT Center, Ministry of Public Health and all Departments. Region Health Provider Ministry of ICT Ministry of Justice Ministry of Interior and the associated Ministry.
			3. Develop an internet data analysis system, by which user can freely select variables to display the data and format of the presentation.		ICT Center, Ministry of Public Health and all Departments. Region Health Provider Ministry of ICT Ministry of Justice Ministry of Interior and the associated Ministry.

Strategy 3: Establish standards of Health Information System, effective data integration and interoperability. (continued)

Goals	KPIs	Strategic goals	Tactics	Flagship	Principle person
			Tactic 5 Develop a surveillance - tracking and forecasting health system. 1. Develop health system resource tracking and health surveillance systems. 1.1 Develop health surveillance system: • SHOC (Strategic Health Operation Center) to deal with emergencies and to cope with epidemics crisis, including diseases caused by natural disasters. Data must be effective and promptly reported to provide good dicision making to the management of the Ministry of Public Health in emergency situations, and they must include of geographic information technology (GIS) to monitor and report on health hazards. 1.2 Develop health alert systems and communicate through various channels.	2. Develop health system resource tracking and health surveillance systems to deal with emergencies and to cope with epidemics crisis, including diseases caused by natural disasters. Data must be effective and promptly reported to provide good dicision making to the management of the Ministry of Public Health in emergency situations.	Bureau of Health Administration. Bureau of Policy and Strategy, ICT Center, Ministry of Public Health and all Departments. Region Health Provider Ministry of ICT Ministry of Justice Ministry of Interior and the associated Ministry.

Strategy 4 : Promote and develop eHealth innovation, services and applications which provide benefits to health care delivery system and patients, consumer protection including licensing regimes.

Goals	KPIs	Strategic goals	Tactics	Flagship	Principle person
1. Optimize the development and adoption of digital technology innovations as a propel eHealth tool.		Health care service delivery is more effective. People can easily and quickly access services, receive continuous and secure services.	**Tactic 1.** Increase the efficiency of ICT management and propel for eHealth in Software, Hardware, and Peopleware. • Develop a roadmap of standards for health service delivery. • Digital Health and Smart Device technology is used to provide patient services to increase the efficiency of medical treatment such as mHealth and TeleHealth.		ICT Center, Ministry of Public Health and all Departments. Region Health Provider Ministry of ICT Ministry of Justice Ministry of Interior and the associated Ministry.
2. To use the Digital Prototype Project to decrease an effective eHealth.			**Tactic 2** Support and coordinate in research and innovation in health information technology, to provide health services to citizens according to the eHealth management component. (Note: Follows Table 4-2, eHealth Management Components, page 36)		ICT Center, Ministry of Public Health and all Departments. Region Health Provider Ministry of ICT Ministry of Justice Ministry of Interior and the associated Ministry.

Strategy 5 : Establish Laws, regulations, compliances and standards of ICT in Healthcare System.

Goals	KPIs	Strategic goals	Tactics	Flagship	Principle person
	Levels of success in policy setting and law enforcement with every agency, to be consistent with eHealth strategy.		**Tactic 1.** Create a legal environment and eHealth law enforcement to achieve a comprehensive, a nd promulgating a policy.		Legal Department, ICT Center, Ministry of Public Health and all Departments. Region Health Provider Ministry of ICT Ministry of Justice Ministry of Interior and the associated Ministry.

**This strategy focuses on the development of service systems which meet the quality standards. Focus on finding innovation and digital technology solutions to healthcare problems. Building the relationship between provider and recipient, including the development of seamless referral system. (Strategic Health Development Response according to Strategic Health Development Plan No. 12).

Strategy 5 : Establish Laws, regulations, compliances and standards of ICT in Healthcare System. (continued).

Goals	KPIs	Strategic goals	Tactics	Flagship	Principle person
			Tactic 2. Adopt legislation, provision, rules, regulation, criteria and compliance to establish trust and protection for consumers, health personnel and industry in eHealth practice and systems. • Considering information security policy: a classified security information. • Issue a clear eHealth practice guideline for the Ministry of Public Health and another ministry. • Design the required form to protect the safety of eHealth for healthcare personnel and related parties. • Prepare success level of protection (2 dimensions: service recipients and service providers) by activity such as Service Provider Activity as follows; 1. Define policies and define categories of service recipients. 2. The person responsible must be acknowledged by circular letter. 3. Provide public relations channels such as publicity signs in front of the hospital. 4. Provide regular assessment (at least 1 time / month). 5. Report / Summary 6. Review process (1 year / session)		Legal Department, ICT Center, Ministry of Public Health and all Departments. Region Health Provider Ministry of ICT Ministry of Justice Ministry of Interior and the associated Ministry.

Strategy 5 : Establish Laws, regulations, compliances and standards of ICT in Healthcare System. (continued).

Goals	KPIs	Strategic goals	Tactics	Flagship	Principle person
			Service recipients 1. Channel recognition (App, Website, Call Center, SMS) 2. Service recipients' knowledge. The safety of the service recipients. • Media control of eHealth information dissemination.		Legal Department, ICT Center, Ministry of Public Health and all Departments. Region Health Provider Ministry of ICT Ministry of Justice Ministry of Interior and the associated Ministry.
	Success level of data collecting standard and Health information exchange interoperability.		**Tactic 3.** Review and develop eHealth standards to enable consistency and accuracy in Health care services. • Release standard for clear local storage data and issue rules or guidelines for information sharing system. • Release the legal of health information exchange. • Force the Health Information Security Act. • Develop health information Security and Privacy Standards, Rules, Policy, Guideline (Unique Patient Identifier), the technical standards required for securing the privacy of individuals in health information systems, and Unique Patient Identifier Standard.		Legal Department, ICT Center, Ministry of Public Health and all Departments. Region Health Provider Ministry of ICT Ministry of Justice Ministry of Interior and the associated Ministry.

Strategy 5 : Establish Laws, regulations, compliances and standards of ICT in Healthcare System. (continued).

Goals	KPIs	Strategic goals	Tactics	Flagship	Principle person
			Unique Provider Identification and Service Catalog. Standards in data storage must be clear. Data collection should not exceed the scope of what health officers has authorized. The necessity of creating data collection. Effects of information on patients' feelings. • Disclosure Assigning Access Rights. • Data transmission via various channels should be encrypted. • Regulation to protect health officials. • Provide guidelines for staff and enforce the agency to comply with.		ICT Center, Ministry of Public Health and all Departments. Region Health Provider Ministry of ICT Ministry of Justice Ministry of Interior and the associated Ministry.

Strategy 6 : Develop Human Capital in eHealth and ICT Knowledge Management in medical and healthcare for Citizens.

Goals	KPIs	Strategic goals	Tactics	Flagship	Principle person
Enhance the quality of health personnel system development by building an organizational culture, directing, staff management, and work processes.	The clear ehealth personnel planning which has been accepted by the relevant authorities.		**Tactic 1. Create the eHealth Human Resource Management System (HRM)** • Retain/Recruit • Career Path Management: Offers and pushed together with the MoPH Subcommittee on Human Resources to improve the human resources management mechanism which supports ehealth personnel retention. • Income / compensation / incentives. • Personnel Evaluation System.		ICT Center, Ministry of Public Health and all Departments. Region Health Provider Ministry of ICT Ministry of Justice Ministry of Interior and the associated Ministry.

Strategy 6 : Develop Human Capital in eHealth and ICT Knowledge Management in medical and healthcare for Citizens. (continued).

Goals	KPIs	Strategic goals	Tactics	Flagship	Principle person
	Health personnel at all levels must possess a wide variety of eHealth skills and knowledge not less than XXX percent		**actic 2.** **Enhance the eHealth Human Resource Development (HRD)** • Standard Competencies of eHealth workforce. • Standard IT and eHealth Competencies of Health Professions (User) in conjunction with professional council and university including international professional standards. (Certification) • eHealth Authority of the country. - Incorporating KM in e-Health within and between different CoPs for both practitioners and administrators. Create knowledge management policies, knowledge portal, producing expert CVs, learning exchange mechanisms, learning culture. • Provide the ability to propel a process by creating a coordinated learning community. • Engage the CIO of MoPH Departments and Divisions with TMI.		ICT Center, Ministry of Public Health and all Departments. Region Health Provider Ministry of ICT Ministry of Justice Ministry of Interior and the associated Ministry.

Strategy 6 : Develop Human Capital in eHealth and ICT Knowledge Management in medical and healthcare for Citizens. (continued).

Goals	KPIs	Strategic goals	Tactics	Flagship	Principle person
			• IT / eHealth training for executives (Medical and Public Health Executive (AMC), mid-Level Public Health Executive, first level public health administrator (MD) and CIO - Equipping the eHealth workforce training through curriculum standards such as hospital accreditation. • Coordinate with TMI and educational institutions both inside and outside the Ministry of Public Health in all courses, in order to manage eHealth curriculum. • Basic English Training, legal and regulatory aspects of eHealth for eHealth practitioners. • Oganize Talent Management\ System. • Create eHealth Professionals Database and the eHealth workforce database of each agency. standards such as hospital accreditation.		ICT Center, Ministry of Public Health and all Departments. Region Health Provider Ministry of ICT Ministry of Justice Ministry of Interior and the associated Ministry.

Strategy 6 : Develop Human Capital in eHealth and ICT Knowledge Management in medical and healthcare for Citizens. (continued).

Goals	KPIs	Strategic goals	Tactics	Flagship	Principle person
			• Coordinate with TMI and educational institutions both inside and outside the Ministry of Public Health in all courses, in order to manage eHealth curriculum. • Basic English Training, legal and regulatory aspects of eHealth for eHealth practitioners.		ICT Center, Ministry of Public Health and all Departments. Region Health Provider Ministry of ICT Ministry of Justice Ministry of Interior and the associated Ministry.
	• Number of projects collaborations. • Number of people or private companies with joint training.		**Tactic 3.** Promote networking between developers and/or users including the private sectors involved in eHealth. • Encourage cooperation between the public and private sectors to use health information technology and communication in the health service system. By related agencies such as MoPH, CAT, NSTDA & NECTEC, SIPA, Software Park, TMI, PReMA. • Establish a program development team of the Ministry of Public Health to share ideas and collaborate on the development of programs, systems, and tasks. • Organize a mechanism to support the program users such as training, consulting, and troubleshooting. • Share resources between the public and private sectors, such as 43 files sharing.		ICT Center, Ministry of Public Health and all Departments. Region Health Provider Ministry of ICT Ministry of Justice Ministry of Interior and the associated Ministry.

Strategy 6 : Develop Human Capital in eHealth and ICT Knowledge Management in medical and healthcare for Citizens. (continued).

Goals	KPIs	Strategic goals	Tactics	Flagship	Principle person
	Number of medical knowledge articles published on website.		**Tactic 4.** Support education and knowledge in public sector. • Provide basic knowledge and increase awareness of health care through a variety of eHealth's channels such as mobile app, website, multimedia and info graphic. • Support the dissemination of medical knowledge on the website for Health Promotion Knowledge (Consumer Health Knowledge Portal), disease prevention and treatment of all age groups. • Exchange and transfer knowledge and start the knowledge base administration. -Create knowledge base websites in accordance with standards. • Establish credibility of data and verify the quality of data before publishing. • Coordinate with the local government and share overall coordination of eHealth such as resources for develop eHealth work project. • Create a community participation forum in health knowledge management through Information and Communication Technology (ICT).		ICT Center, Ministry of Public Health and all Departments. Region Health Provider Ministry of ICT Ministry of Justice Ministry of Interior and the associated Ministry.

Chapter 5 : Turning Strategies into Action

Editorial board

As stated above, the eHealth strategy is "Using ICT to improve the efficiency and effectiveness of health services, health management and health communication". This eHealth strategy was presented and screened through comments from representatives from relevant national sectors. This will help push eHealth strategy into implementation.

To accomplish the eHealth Strategy all strategies must be clear and support the national health vision. They and can be used as a framework to the successful implementation of ehealth. An effective ehealth operation can be driven by the following guidelines.

5.1 eHealth Action Lines

Action Lines	Description	Mapped eHealth Components
1. Governance	Establishment of governance structures, mechanisms and processes to provide effective leadership and oversight of the national eHealth agenda.	Governance/ Strategy and Investment
2. Foundations	Establishment of infrastructures, standards, rules and protocols for effective implementation of eHealth services, processes and solutions.	Infrastructure/Standard and Interoperability/Legislation Policy and Compliance
3. eHealth Solutions	Computing services, processes, solutions, and/or tools to achieve the eHealth vision.	Services and Applications
4. Change and Adoption	Activities to motivate, encourage and require concerned users/ stakeholders to adopt eHealth solutions and comply with the requirements.	Human Resources

5.2 eHealth Targets

Development phase	year		Description
Phase 1 eHealth foundations and Investment	Short term	1 year and 6 month	• Building consensus on eHealth Policy interoperability and adoption of standards: HIS (Personal Health Record) • Enable the health sector to operate more effectively as a connected system for health service delivery.
Phase 2 eHealth Inclusion: All sectors of Thailand are involved in eHealth operations.	Middle term	5 years	eHealth is often realized through national health reform which covers the following areas. 1. eHealth foundations 2. Legal frameworks for eHealth 3. Telehealth 4. Electronic health records 5. Use of eLearning in health sciences 6. mHealth 7. Social media 8. Big data
Phase 3 eHealth Transformation: Thailand steps into eHealth, driving healthier systems by leveraging innovative digital capabilities.	Long term	10 years	Thailand propels the health system by leveraging digital innovation to its fullest potential. Smart Health Care is on pace to advance health care reform by fully utilizing disruptive technology. Positively affect public health economics. Add value to the healthcare industry.
Phase 4 eHealth Leadership Thailand will be one of the best health care system countries by adding economic value to the health care system with digital technology for improving a good quality of life in people.	Continuous and stability	10 – 20 years	Improvement, management, continuity monitoring and evaluation to make people healthier and to best serve their needs. Also, citizens are protected by social and financial risks. Bankruptcy of medical expenses is avoided. eHealth will be used to improve efficiency and create value in a long-term and sustainable development.

5.3 eHealth Targets of implementation in 1 year and 6 month

Phase	Duration	Description
1. Short term	2016 - 2017	eHealth policy, HIS standard and interoperability, pilot project on personal health information (Personal Health Record), delivery of health services and public services.

eHealth Governance

Signing a framework agreement on cooperation between the Ministry of Public Health with relevant ministries and departments. Endorse a technology agreement to establish a technical eHealth commission and working group, to achieve collaboration, follow up and monitor the development of strategic framework, program and / or eHealth project of the country which are contained in the plan.

National health information committee, health information policy and operations, processes and guidelines for implementation.
- Review, evaluate, and make recommendations for the development of the National Health Data Dictionary.
- Establish a National Health Information Board to support national health information standards and implementation guidelines for eHealth interoperation by Data Exchange Standards.
- Develop policy and legal mechanisms to support the development of electronic health information systems and health information standards. This includes: support for implementation and compliance with standards of information exchange between the public and private sector, privacy and confidentiality should be enacted to protect people. - Develop a Roadmap for implementation of health information systems and standards at national and local level.
- Integration & Exchange of Health Information.

Draft national data standards for national health information reporting and implementation policies, procedures and / or guidelines for implementation.

National Telehealth Service.

eHealth foundations

Regulatory, legislative bodies.

Create a collaborative framework.

eHealth Enterprise Architecture.

Minimum Data Sets for Health Information Exchange.

Infrastructure Operations
- Data Warehouse Connectivity
- Database Infrastructure
- Interoperability Layer Infrastructure

eHealth solution

Pilot project on Personal Health Record, Health Care Delivery and pilot project phase 1 such as Telemedicine, mHealth.

Development and implementation of Phase 1 health information exchange (pilot sites can be identified).

5.4 eHealth Governance

eHealth Governance is necessary to sustain strategic alignment which the overall results depend on the performance of the rest of the dimensions, especially the acceptance of eHealth, which is varying among both citizens and medical professionals. Without general acceptance of eHealth, the continued generation of innovative health care technologies is not possible. Thus, the overall objective of the ICT for Health project is to persuade citizens and medical professionals in the partner regions to accept eHealth more readily, and to have the capacity and knowledge to use eHealth technologies in prevention and treatment. There will be useful learning exchanges which will promote a better performance in such a way useful learning exchanges will promote a better performance. 12 Health service areas will be a major driving force in the Ministry of Public Health.

eHealth training will help people to improve their knowledge and performance. However, eHealth budget and investment are important to both public and private sectors. Joint roles must be defined, including the ability of personnel to develop a framework for privacy and security. Standard framework and certification will lead to personal development and public health outcomes. Transparency and efficiency in improving the ability to learn and provide health services are neccesary.Research to optimize eHealth is something to keep in mind, because the trend of digital technology has changed dramatically. eHealth research and education will benefit sustainable development.
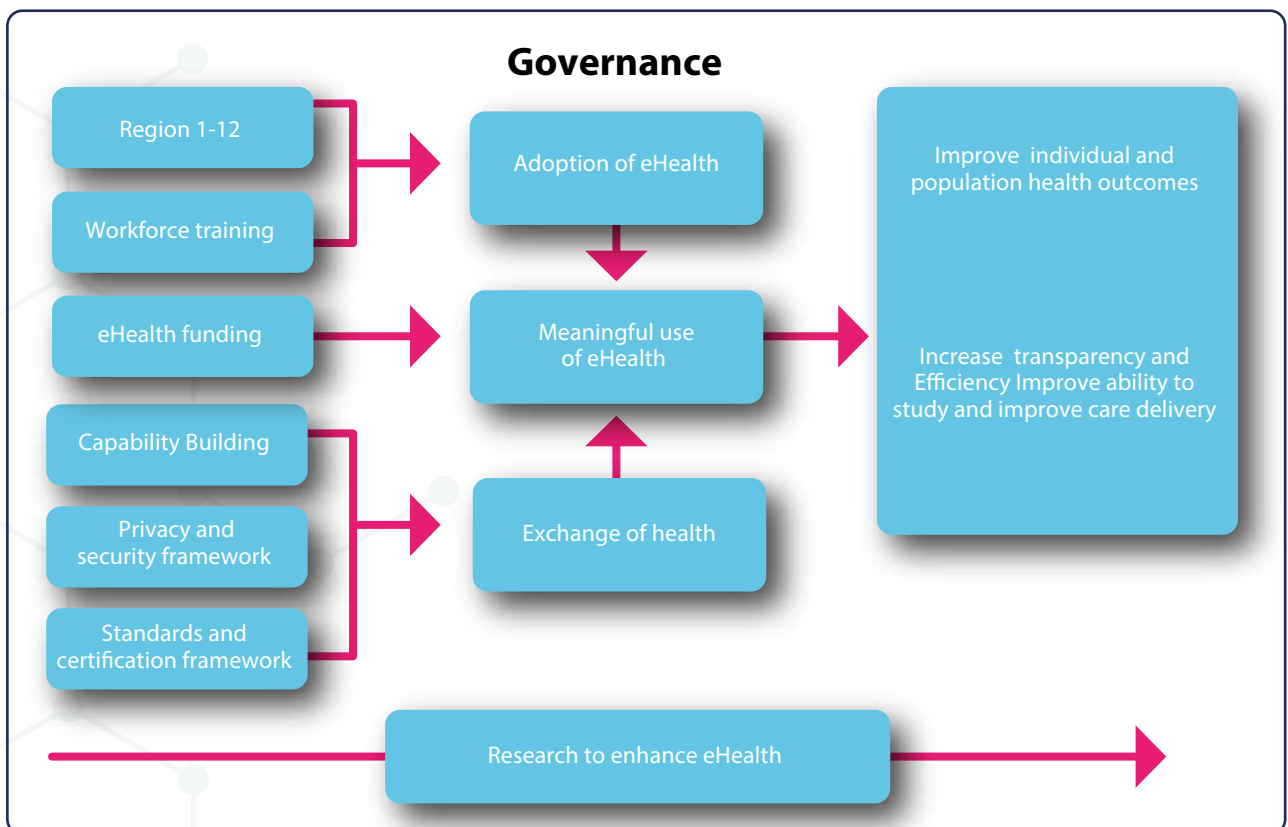

Figure 5.4 eHealth Governance

eHealth includes standardization and health data connectivity. There are pilot projects in the field of Personal Health Record and innovative development of health service delivery. In order to succeed in eHealth implementation, the policy must be put into action by creating an eHealth Action Plan (short-term, medium term, long term action plan), and then having an ongoing eHealth monitoring and evaluation management.

The development of eHealth strategy can be prepared and adapt to the changing environment with good management as well as manpower planning, budget planning, collaboration with stakeholders and both public and private sectors, which should drive each component simultaneously.

5.5 eHealth Transformation

The cycle of change and its consequent impact will come to the IT and the people inevitably. Creating engagement in eHealth operations with all sectors, by having a shared vision, identify opportunities for challenges in the health system, collaborative design, problem-solving, monitoring performance, including continuous improvement and exchange. It will help to modify the eHealth system effectively, as detailed in Figure 5.2.

eHealth Transformation

Create a cycle of change and impact.

Create engagement.	Design and accomplish	Continuous improvement and learning.
1 Framework of participation	**4** Identify ways and opportunities for change and impact.	**7** Track and analyze performance
2 Build stakeholder engagement.	**5** Co-design a solution and cooperate	**8** Improve and exchange learning continuously
3 Build understanding and shared vision	**6** Commence as planned	

Figure 5.5 eHealth Transformation

Strategies will be realized and empirically obvious when they are put in to practice by setting up a project and action plan. Activity indicators are monitored by individual players (Department / Division / Province / Province) which use appropriate tools. The strategy can be transformed into a project. It is necessary not forget to ask. Why do we need to do this project / activity?, What to do?, What is the need, and what is the benefit?. The project must remain within the strategic boundaries.

Inform health policy & Health service planning improve access to care Efficiency, productivity, cost-effectiveness
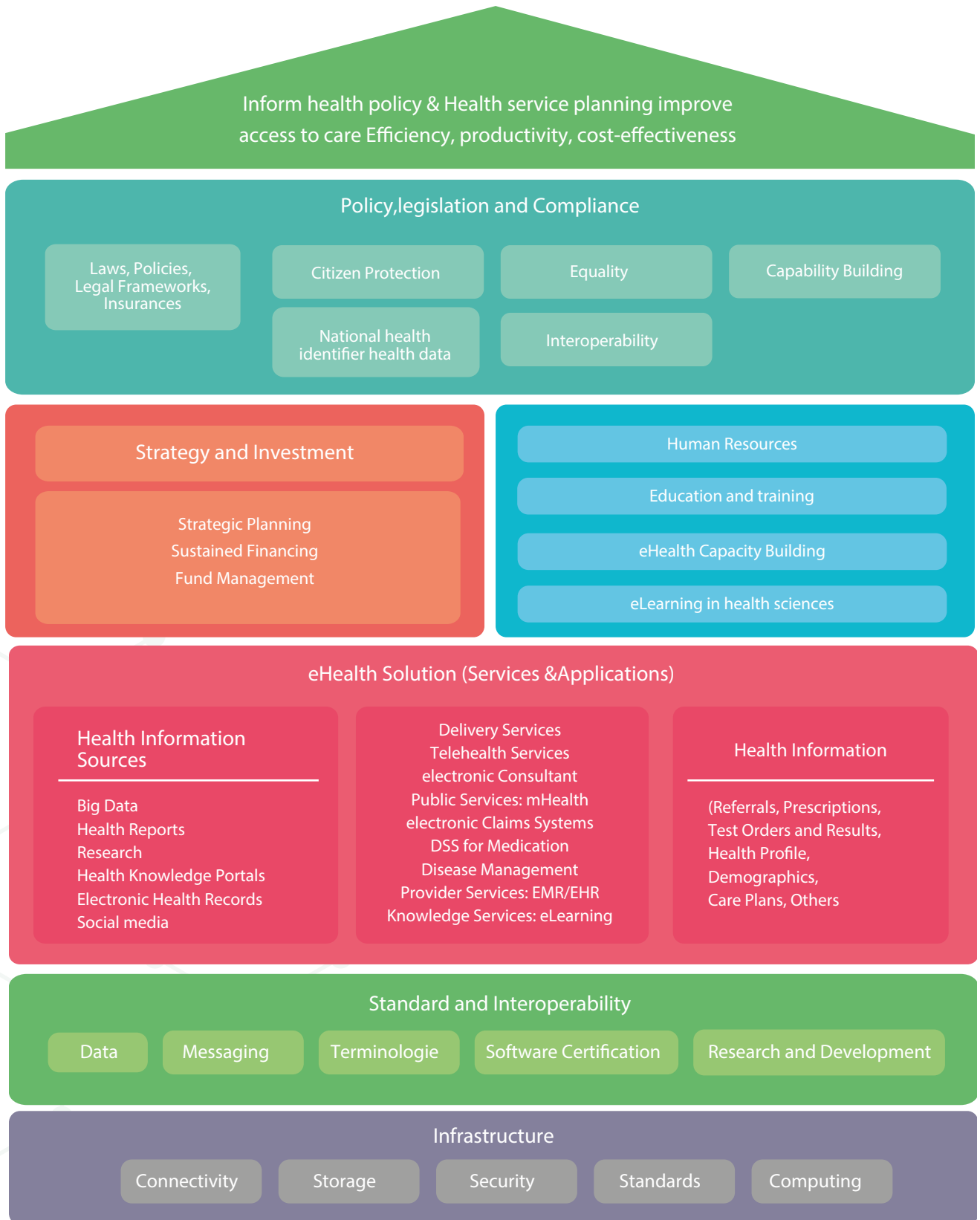
Policy,legislation and Compliance

Laws, Policies, Legal Frameworks, Insurances

Citizen Protection

Equality

Capability Building

National health identifier health data

Interoperability

Strategy and Investment

Strategic Planning
Sustained Financing
Fund Management

Human Resources

Education and training

eHealth Capacity Building

eLearning in health sciences

eHealth Solution (Services &Applications)

Health Information Sources

Big Data
Health Reports
Research
Health Knowledge Portals
Electronic Health Records
Social media

Delivery Services
Telehealth Services
electronic Consultant
Public Services: mHealth
electronic Claims Systems
DSS for Medication
Disease Management
Provider Services: EMR/EHR
Knowledge Services: eLearning

Health Information

(Referrals, Prescriptions,
Test Orders and Results,
Health Profile,
Demographics,
Care Plans, Others

Standard and Interoperability

Data

Messaging

Terminologie

Software Certification

Research and Development

Infrastructure

Connectivity

Storage

Security

Standards

Computing

Figure 5.6 eHealth Enterprise Architecture

The purpose of eHealth Enterprise Architecture as to Figure 5.6 above is to act as a Design Authority which facilitates the strategic development of architecture, technology and operational capabilities in a standardised and aligned manner, conformant with both the knowledge and information operating model and eHealth Strategy.

The most advanced ICT and good governanance will improve quality of life for Thai people and bring Thailand ahead in the digital age. An appropriate eHealth management and elevation of the quality, optimizing and reducing the risk of health service delivery can be helped by a clear roadmap.

Figure 5.7 below is an example of placing an eHealth implementation roadmap as a guideline for bringing eHealth to a destination.
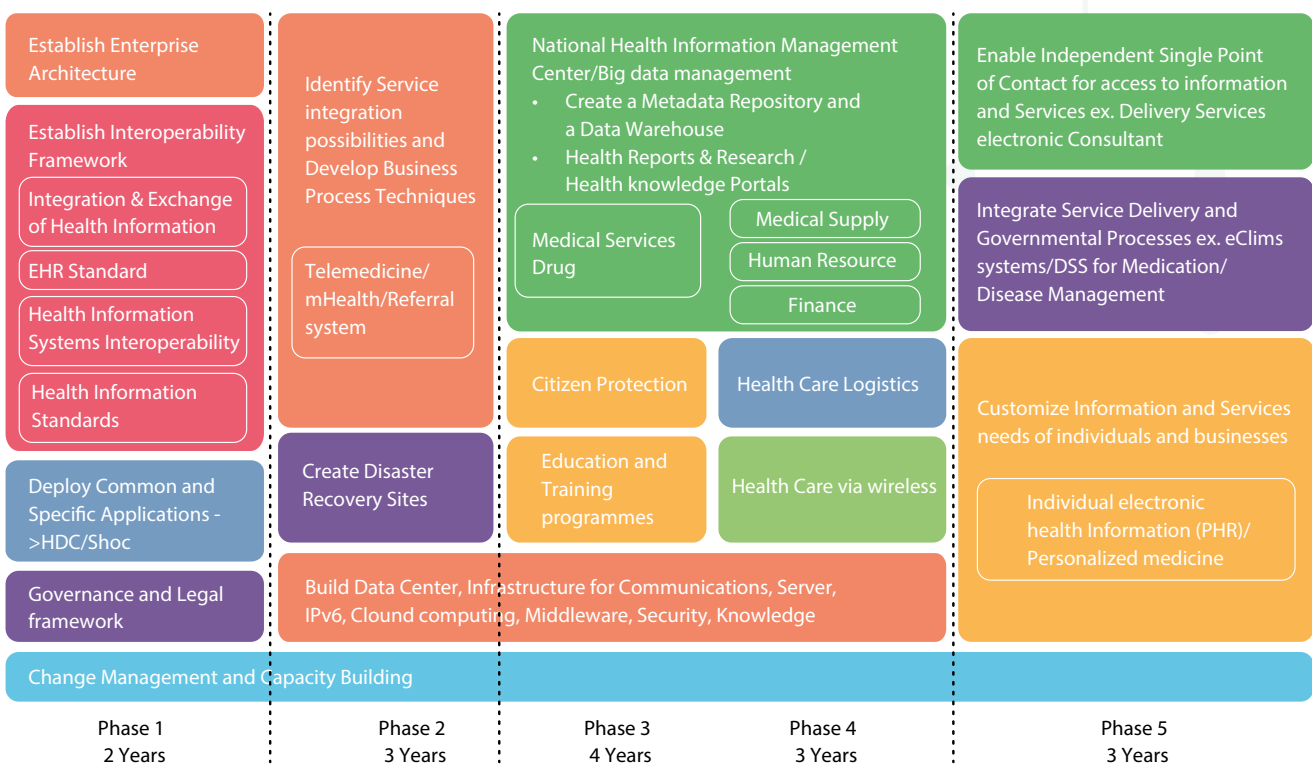

Figure 5.7 An example of eHealth implementation roadmap (phases of implementation)

Chapter 6 : eHealth operations align with The National Public Health Strategy and Digital Thailand

Asst. Prof. Polawat Witoolkollachit, MD.

The goal of eHealth Strategy, Ministry of Public Health, which is "Citizens have improved health from accessing and utilizing eHealth sustainably. Local communities and partner networks benefit from eHealth."

The mission is to develop an effective information technology management system for the country, which serve as a hub for networking partners to drive eHealth to improve people's wellbeing. This aimed to propel public health mission in achieving the following vision:

"A strong, equal and efficient eHealth strategy to improve the quality of life for Thai citizens by 2020."

The Information and Communication Technology Center has analyzed the alignment between the eHealth Strategy, the 20-year national strategy and the Digital Economy for eHealth implementation, reform of the health system, under the Governance Excellence strategy - one of the four excellence strategies of The Ministry of Public Health as shown in Figure 6-1.
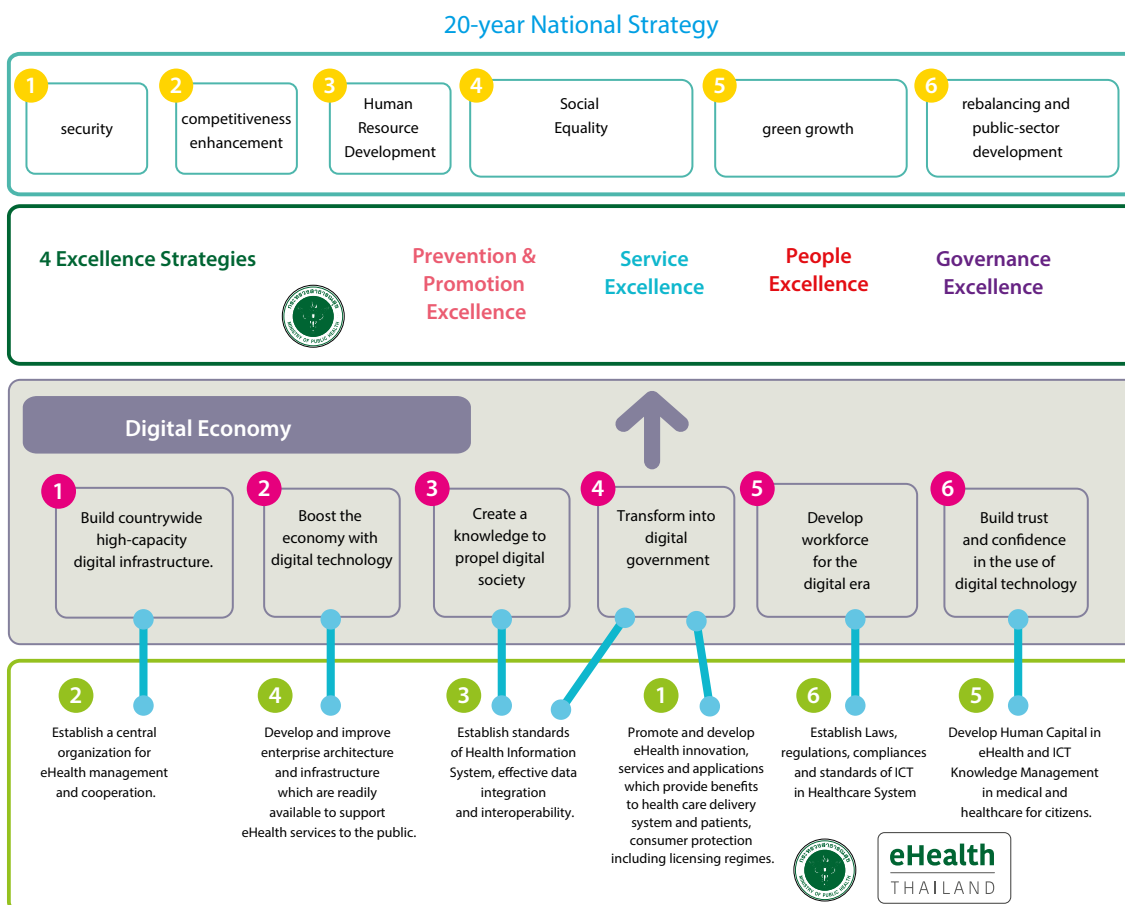

Figure 6-1 Show eHealth strategic linked with 20-year national strategy, and Digital Economy Development Plan.

The Figure as showing above enhances confidence in the progress of health information technology projects that are likely to succeed in the same direction as Thailand 4.0. and the 20-year national strategy, which is expected to help the country to achieve sustainable development. It is crucial for Thailand to have clear directions for long-term development. Thailand realized its vision as a developed nation with "Stability, Prosperity, and Sustainability" in accordance with the principles of Sufficiency Economy Philosophy.

The 20-year national strategic plan consists of six areas, six primary strategies, and four supporting strategies. The six areas include (1) security, (2) competitiveness enhancement, (3) human resource development, (4) social equality, (5) green growth, and (6) rebalancing and public-sector development.

The six primary strategies seek to enhance and develop the potential of human capital: ensure justice and reduce social disparities; strengthen the economy and enhance competitiveness on a sustainable basis; promote green growth for sustainable development; bring about national stability for national development toward prosperity and sustainability; and enhance the efficiency of public sector management and promote good governance.

As for the four supporting strategies for efficient national development, they involve infrastructure development and the logistics system; science and technology, research, and innovation; urban, regional, and economic zone development; and international cooperation for development.

The five-year 12th National Economic and Social Development Plan will continue to focus on the Philosophy of Sufficiency Economy, which stresses a "middle path" and comprises the three principles of moderation, reasonableness, and self-immunity.

Thailand is entering the fourth industrial revolution, known as "Thailand 4.0." Thailand 4.0 policy will be achieved by reforming Thailand's existing five industries, or the "First S-Curve," and promoting five new industries, or the "New S-Curve," in which Thailand has the potential to succeed.

The First S-Curve industries include automotive, electronics, affluent medical and wellness tourism, agriculture and biotechnology, and food. The New S-Curve industries include robotics, aviation and logistics, biofuels and biochemicals, the digital industry, and the medical hub.

The eHealth strategy would be mapped out in line with the 20-year national strategy, National Economic and Social Development Plan and Thailand 4.0.

Thailand Digital Economy and Society Development Plan.

VISION

Digital Thailand refers to the country's brilliance in taking full and creative advantage of digital technology to develop infrastructure, innovation, data capability, human capital, and other resources, thus propelling the country's economic and social development towards stability, prosperity, and sustainability.

10-Year Goals

1. Competitiveness: Thailand will place in the top 15 of the World Competitiveness Scoreboard, Digital sectors will make at least 25% contribution to GDP.
2. Equal Opportunities: All Thais will have access to broadband Internet, as a basic utility.
3. Human Capital: All Thais will be digitally literate.
4. Government Reform
   Thailand will place in the top 50 of the UN e-Government rankings
   Thailand will place in the top 40 of the ICT Development Index (IDI)

6 Strategies

1. Build countrywide high-capacity digital infrastructure.
   Ensuring accessibility, availability, and affordability.
2. Boost the economy with digital technology.
   Driving New S-Curve, Raising Competitiveness, Building new businesses, Creating values.
3. Create a knowledge to propel digital society.
   Building participation, Ensuring inclusive and equal usage.
4. Transform into digital government.
   Creating open government, facilitating people and businesses, Integrating into One Government
5. Develop workforce for the digital era.
   Developing skilled workforce, Creating jobs Building strength from within.
6. Build trust and confidence in the use of digital technology.
   Updating laws and regulations, encouraging investments, Ensuring security.

There is consistency in every strategy of the Digital Economy (DE) plan to drive Thailand 4.0. According to government policy stated by Prime Minister General Prayut Chan-o-cha, specifically, the third strategic of Thailand 4.0 is to create as society of equality and quality through digital technology; to ensure inclusiveness of people of all groups and abilities, especially the farmers group, remote communities, the elderly, the underprivileged and the disabled. People of all groups can access to and use services through digital technology easily and conveniently.

The details of Thailand 4.0 Strategy 3 ; To create a quality and equitable society through digital technology; are:

1. Ensure inclusive and equal access to digital technology.
2. Develop digital literacy/ media and information literacy.
3. Create local digital content and knowledge resources.
4. Provide education opportunities with digital technology.
5. Increase access to healthcare with digital technology.

Goals

1. People of all groups and abilities will be able to access and make use of digital technology.
2. All Thais will become digitally literate.
3. Education, healthcare, and essential public services will be accessed via digital means.

In order to put Thailand 4.0 in to action, to increase access to healthcare with digital technology, there are 3 work plans, including:

5.1) Integrate Personal Health Record (PHR) system which connects across the country. People can access and manage their health information. This facilitate the admission of patients and it is important information for emergency treatment.
5.2) Integrate and promote the use of appropriate digital technology for Telemedicine. Problem solving and knowledge exchange. Surveillance and communication of health and hygiene alerts, including the application of new technology in health to support good health or reduce public health problems. Especially people in remote areas, mother and child groups, elderly and handicapped groups.
5.3) Accelerate policies and operational plans for digital technology, preparing for an aging society by integrating with the relevant medical organizations, digital technology science and technology and social development.

For a long distance medical service (Telemedicine), The Office of the Permanent Secretary of Ministry of Public Health has been working on satellite medical systems since 1995 in regional hospitals, Rajavithi Hospital, and Ramathibodi Hospital. By satellite 1/8 C-band, 1/8 transponder on Very Small Aperture Terminal (VSAT).

This is a telecommunication system that is suitable for large distances between remote areas. No impact from rain or clouds on transmissions which represented the best solution for satellite medical systems at that time. Subsequently, the project was terminated in 2002, due to many factors. But the attempt to bring information-based communication technology to public health had not come to an end.

In 2011 The Office of the Permanent Secretary, Ministry of Public Health started the video conference program between the central management and regional administrators (Provincial health offices nationwide). It aimed to optimize the speed clarity in rush orders, emergency situations about health hazards outbreak. Disaster relief assistance could be required by the medical team to provide care to people in disaster areas throughout the country. This strategy proved to be successful. The program reduced the amout of budget for traveling expenses and help to increase the benefits of spotting particular health problems in various areas throughout the country quickly.
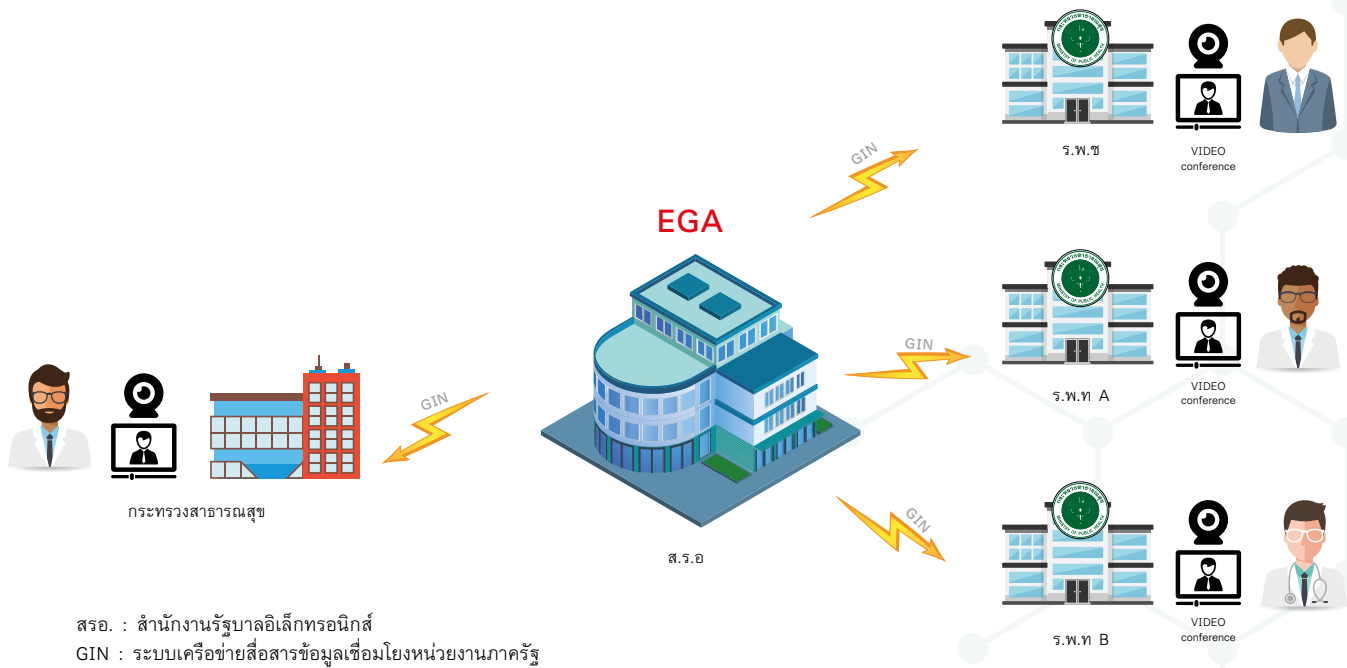
Figure 6-2 Remote conferencing link Through Government Information Network (GIN)

At the moment Thailand is ready to use information technology infrastructure, with quality, speed, and stability. There are important government policies that focus on the country's economic and social development through digital technology like the expansion of optical fiber network.

The Office of the Permanent Secretary, Ministry of Public Health has been leading the telemedicine project experience in the past to analyze the factors of success. A summary of the proposals for the implementation of the telemedicine prototype project are as follows:

• Use the Government Infrastructure Network (GIN) to communicate visual and audio information.
• High-definition (HD) VDO system with high resolution of both video and audio.
• Help doctors communicate clearly to obtain more accurate diagnosis.
• Work in line with the Ministry of Public Health Service Plan. A community hospital can refer to the general hospital through clear guidelines in order for a doctor to be responsible for every step of patient's treatment.

Digital Thailand is defined as a transformed Thailand that maximizes the use of digital technologies in all socio-economic activities in order to develop infrastructure, innovation, data, human capital, and other digital resources that will ultimately drive the country towards wealth, stability, and sustainability.

Linkage between eHealth Strategy and Digital Development Strategy for Economic and Social Development (DE)

The eHealth Strategy of The Ministry of Public Health is consistent with the strategy of the Digital Development for Economic and Social Development Plan. They are displayed below.

	Digital Economy		eHealth Strategy
1	Build country-wide high-capacity digital infrastructure	2	Develop and improve enterprise architecture and infrastructure which are readily available to support eHealth services to the public.
2	Boost the economy with digital technology	4	Promote and develop eHealth innovation, services and applications which provide benefits to health care delivery system and patients, consumer protection including licensing regimes.
3	Create a quality and equitable society through digital technology	3	Establish standards of Health Information System, effective data integration and interoperability.
4	Transform into digital government	1	Establish a central organization for eHealth management and cooperation.
5	Develop workforce for the digital er	6	Establish Laws, regulations, compliances and standards of ICT in Healthcare System.
6	Build trust and confidence in the use of digital technology	5	Develop Human Capital in eHealth and ICT Knowledge Management in medical and healthcare for Citizens.

eHealth strategy will be an important mechanism to drive Thailand 4.0 to Health 4.0. It is an important part of the development of the Digital Government. ICT presents many opportunities for improving the performance of health systems in developing countries, especially for the country's economic and social development.
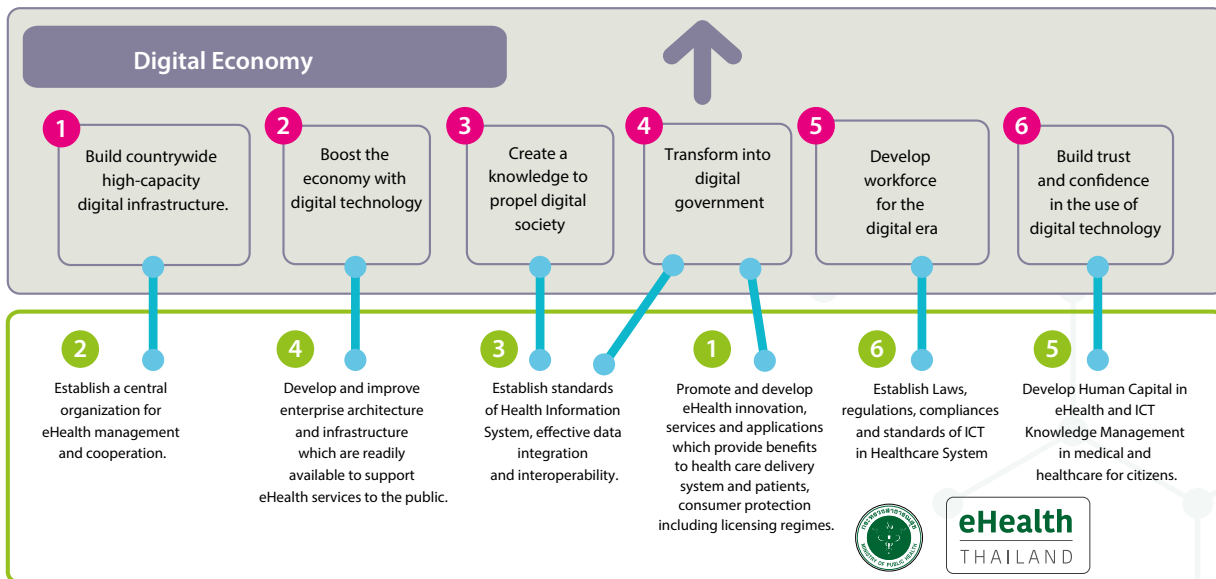

Figure 6-3 shows the eHealth Strategy linkage with the Digital Economy Strategy.

eHealth operations driven into Health 4.0

The Ministry of Public Health conducts the eHealth Strategy in the form of a board of directors, working groups and reform groups, by integrating cooperation at all levels; from management to service units in all provinces in Thailand. It has clear policies and working principles in coordination with other sectors; especially civil society, local administration, public sector, community, house, temple, school. Bringing digital technology as a tool to manage and develop a shared public service improve people's quality of life according to The Digital Government Development Strategy of Thailand.

First step is a key mechanism in transition to digital government which is the data integration through secure data exchange and interoperability, especially for personal health information. This is a very sensible information, and high value. There is a need for strict risk management as well as the risk of data, risks in storage and the risk of data users. This data integration process should have the obligation to provide "fair and equitable services".

eHealth operations under the eHealth Strategy, Ministry of Public Health, can be summarized briefly as follows:

Computer network infrastructure, including:

- WAN Intranet of the Office of the Permanent Secretary for Public Health. It covers all provincial health offices at a speed of at least 10Mbps, and linking all centers / general hospitals across the country at a speed of at least 5Mbps.

- Connecting the Government Information Network (GIN) covers the provincial public health office and every center / general hospital across the country at a speed of at least 2Mbps [15]

- Broadband Internet service using broadband speeds of at least 10/30 Mbps according to the minimum speed of government to regional agencies in the central and northeast (community hospital, district health office, district

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[15] MOU DE : Memorandum of Cooperation, Enhancing Quality of Health Services through Digital Technology between Digital Ministry for Economic and Social Affairs, Ministry of Public Health, and e-government office (Public Organization) on 5 January 2017.

health promotion hospital and community health) at total amout of not less than 6,800 locations by providing an integrated service provider (ISP). This could help saving budget up to 30 million baht per year.

- Local Area Network (WAN Intranet) between departments under the Ministry of Public Health (MoPH Campus) at a speed of at least 10Gbps.

- BGP Multihoming Techniques provides high-speed Internet access to all 3 Internet services from 3 service providers (ISPs) which helps users not to be affected by a particular route fault.

Digital Economy Driving, including:

- Information and Communication Technology Center, Office of the Permanent Secretary, Ministry of Public Health, organize the annual Innovative Health Software Contest to support start - up in Digital Health Information Technology along with the ICT Conference of The Ministry of Public Health Information Technology.

- Organization of the Health Data Center (HDC), database system with Big Data technology, which provides a wide range of analytical tools for quick results (Axis Project). Disease and illness situations can quickly and accurately be controlled and solutions can be prepared.

- Departments under the Ministry of Public Health have developed a digital system to support their operations and to provide services to the public, such as the Health Food Logistics System of the Food and Drug Administration, the Medical Hub Information System of the Department of Health Service Support and Disease Information System of the Department of Disease Control.

- More than 400 ICT staff members of the Ministry of Public Health have had the opportunity to attend academic meetings on the international forum. This is an extension of knowledge and a universal experience. For example, the HIMSS AsiaPac16 Conference and Exhibition, HIMSS Asia Pacific 16 and HIMSS Asia Pacific Conference and Exhibition, 23 - 26 August 2016 at Queen Sirikit National Convention Center. [16]

Equal Opportunities in accessing the Digital Technology

- The Office of the Permanent Secretary, Ministry of Public Health, has developed the National Refer data xChange (nRefer) system for information exchange between hospitals and for keep track of the treatments between the transfusion hospitals and medical facilities. This is a system that supports exchange of information from different.

Platform. Currently, there are hospitals under the Office of the Permanent Secretary, Ministry of Public Health, affiliated with various departments and university hospitals such as Ramathibodi Hospital, Siriraj Hospital.
- Information and Communication Technology Center, Office of the Permanent Secretary, Ministry of Public Health, initiated MOPHID, a unique set which represents a person ID number replacement for hospital recipients in order to handle the problem of foreign patients, and groups without ID number.

- ICT Center started a National Queue Development Program with hospitals under the Office of the Permanent Secretary, Ministry of Public Health and the University Hospitals to support the Smart City to reduce congestion in hospitals and to increase the level of satisfaction for health care recipients.

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[16] MOU HIMSS: Memorandum of Understanding HIMSS Asia Pacific Conference and Exhibition 16 in Thailand (HIMSS AsiaPac16 Conference and Exhibition) between Dr. Suriya Wongkongkathep, Deputy Permanent Secretary, Ministry of Public Health Senior Information Technology Executive (CIO) and Jeremy Bonfini, Executive Vice President, Healthcare Information Management System Society (HIMSS), on September 23, 2015.

- The Ministry of Public Health has developed the Emergency Medical and Public Health Service (EOC) to serve as a referral center for patients and information about casualties and deaths, as well as medical team performance data, drugs and medicines. Volunteer teams can report available information and respond to orders immediately.

- A video conference system links all provincial health offices nationwide. It improves internal communication (Internal Relationship). It is a tool that helps to prepare emergency situations.

- Agencies under the Ministry of Public Health developed mobile application to serve the public and public health officials, such as health information service, online transaction services, health checkup service, emergency medical services, GIS Health, Hospital Search, EMS 1669, Emergency Alert, Khun Look, Oryor Smart Application, Thai Herbs, etc. These applications are founded at the following internet address of The Ministry of Public Health: https://www. moph. go.th/index.php/home/app_moph

Transformation to digital government

- ICT Center developed a hospital information system named JHOS for inpatient hospitals and JHCIS for outpatient hospitals. It began to develop the Government Service Platform to link citizen ID of patients according to Health Standard Data Structure (43 Files) through Health Data Center (Central Medical Archive).

- The Ministry of Public Health executes the project to develop a drug and pharmaceutical database, pharmacy management system, finance, drug information system, develop electronic drug store system coordinate with the Healthcare Supply Chain Excellence Centre (LogHealth) of Mahidol University.[17]

- Development of information management support systems such as HROPS for human resources management, the system of electronic financial services, complaint management system, electronic documentation system and central data center system of The Ministry of Public Health (Call Center)

Confidence in digital technology.

- The DR-Site system is located in Sriracha, Chonburi Province. It is a hot site for the Domain Name Server (DNS) and health information system from the 43files database (hdcservice) and a warm site for the main website system, and the central administration support database of the Office of the Permanent Secretary of Public Health.

- The Ministry of Public Health established a data center in accordance with Uptime Teir II and ISO 27001 standard within The Ministry of Public Health, Nonthaburi, provides MOPH private cloud in the form of infrastructure as A Service (IaaS) and storage, hardware, servers and network services to agencies which operate under the Ministry of Public Health.

- The Office of the Permanent Secretary, Ministry of Public Health has synchronized data with National Bureau of Statistics (13-digit public identification or Smart Card ID), Department of Administration, Ministry of Interior through the Broker Server in order to access the public database with the Population Information Center or GIN.[18]

- There is a standard for exchanging information between public health systems as a guideline for the implementation of Personal Health Records (PHRs), also data protection practices in Electronic Health Records systems by working jointly through a board of representatives from various organizations inside and outside the ministry.

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[17] MOU Loghealth : Memorandum of Understanding on the Development of Logistics System, Infrastructure and Integrated Information System on Public Health for Digital Economy Thailand, between Mahidol University, Ministry of Public Health,National Research Council of Thailand and the Pharmaceutical Society of Thailand on 29 November 2016 at Maruay Garden Hotel.
[18] MOU DOPA: Memorandum of Cooperation 19 state agencies in piloting the implementation of the National Database and Service Integration Guidelines on 22 September 2016, at Ministry of Interior.

Five-Year eHealth Action Plan Compliant with Digital Economy

Digital Economy	eHealth goal for 5 years
Strategies 1 and 3	• All units within the Ministry of Public Health can be interconnected with the internal network (MoPH Intranet) safely and meet international standards. • Extend special high-speed Internet service to all district health promotion hospitals nationwide. • Link the Government Information Network (GIN) to cover all community hospitals nationwide. • There is a backup system of all Central / General hospitals across the country.
Strategies 2 and 6	• Smart Service (PHRs, EMR, Registration) including health products in service units are available. • Increase economic value by developing the knowledge in self-care with personal electronic health records (PHRs). • There is a law in modern health systems linked to the implementation of the Digital Economy and Social Development Plan. • Provide a large number of Health Digital Literacy Centers which are a good source of knowledge for Thailand. People can be quickly access and use, they can prevent misunderstandings that may pose a health risk and suppress the spread of distorted information in the social media world. • Quality Tele-medicine system support for diagnostic and counseling services between medical specialists and doctors in distant hospitals, especially the marginalized hospital.
Strategies 3, 4 and 5	• Health system personnel have the potential to utilize digital technology to improve workflow for better performance. • The integration of information systems between health care professionals and hospitals in the Ministry of Public Health.

Summarize

Thailand 4.0 is a policy vision of Thailand's economic development or a model of the government's economic development under the administration of Gen Prayut Chan-o-cha, Prime Minister. The Prime Minister has managed the country with the vision of stability, prosperity and sustainability to achieve the key reform missions to adjust, organize and align directions and create the country's development guidelines to cope with new, rapidly changing opportunities and threats of the 21st century. Modern developments in information and communication technologies (ICT) provide exciting possibilities to enhance the quality of health care, and its potential to improve effectiveness and efficiency has been recognized by governments worldwide. eHealth strategy aims to improve the safety, quality and efficiency of patient care by enabling access to electronic health records and by supporting clinical practice, service management, research and policy through availability of appropriate evidence and data. In addition, these strategies emphasize the importance of standards and policies for ensuring interoperability and data security, and many incorporate a commitment to facilitate consumer empowerment and patient self-care through provision of electronic information and/or telemedicine facilities.

But the challenge of driving the health system of Thailand into eHealth completely, is either to develop the potential of medical and public health personnel to have digital technology skills, or to achieve the training of personnel in order to have expertise in both medical and digital (Health IT) within a limited time. It is also necessary to encourage people to have a better understanding of the meaning of eHealth. The relevance and self-interest include allowing people to use digital technology to take advantage of health information safely to maintain their own health and that of their family. The Ministry of Public Health would like to thank all agencies cooperating in helping us to ensure the eHealth Strategy, Ministry of Public Health (2017 - 2021). Hopefully we will continue to work well together in a more integrated way with all our partners, the public and private sectors for long-term development and sustainability. To propel the Thai public health to the Health 4.0 era and achieve a vision: **"A strong, equal and efficient eHealth strategy to improve the quality of life for Thai citizens by 2020."**

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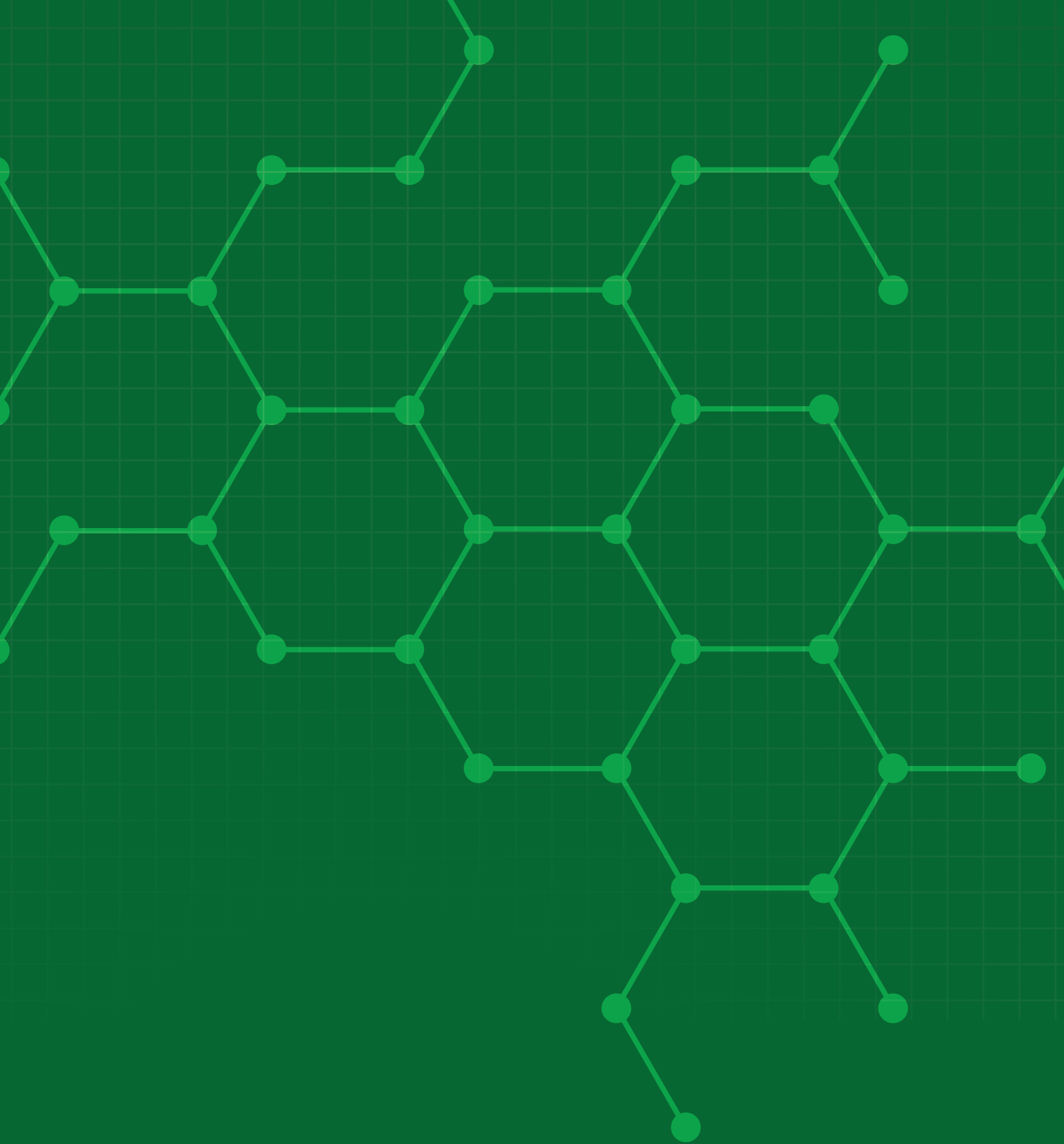
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