A Sustainable Medical Tourism Framework Based on the Enterprise Architecture Design: The Case in Thailand

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Abstract

Presently, medical tourism is a rapidly growing business in Thailand, while sustainable medicine is still being widely used as the basis for health policies. To improve the quality of life of people through holistic management, Enterprise Architecture (EA) is used as the strategic management concept in accordance with digital disruption. EA combines both business and technology to align policies and establish governance. This paper presents a medical tourism framework based on the EA concept for sustainable development in Thailand. This novel framework has been developed both through comprehensive literature review as well as requirement analysis based on the i* model consisting of five layers including leadership, business, application, data, and technology. Moreover, the i* model is used to prove a relationship between the entities, especially the key stakeholders, the standards, and the compliance for each layer. The content validity and the kappa statistic were used for quantitative evaluation. This framework demonstrates that technology would contribute to enhance the medical tourism industry through the layers of data and application. Furthermore, the interoperability standard for health services, preventive medicine, and wellness activities are important for business layers. The proposed framework would generate advantages for the government in terms of good governance, transparency as well as process improvement.

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1 Introduction

Thailand is one of the dream destination of tourism, especially medical tourism because of the quality of medical care, reasonable prices, and all the other attractiveness of the tourism industry [1, 2]. The local bank has reported that medical tourism is a high growth business and an important facet in generating revenue for the private hospitals, especially through foreign customers [3]. Evidence has shown that income through medical tourism in the private hospitals has increased from 25% to 27% within 4 years (2011–2014) and claimed to be 30% in 2017. Thailand has higher strengths compared to other nearby countries such as Malaysia, Singapore, India and South Korea in hospitality, accessibility, professionalism, medical technology, and lower cost. These competitive advantages promote Thailand to be an excellent medical hub. The Thai government has, therefore, decided to make the medical hub policies as part of the national plan, which has, with time, evolved the quality of the medical tourism services [4]. There are however existing obstacles in the implementation of the policies, which are due to the lack of widespread coordination and technological support. A valid guideline is therefore required to support and integrate every part of the policies with the technological innovations.

Medical tourism is considered as a travel program related to the physical and psychological health of an individual in terms of maintenance, treatment, improvement, or restoration of wellbeing [5, 6]. Examples of popular medical tourism services are dental care, cosmetic surgery, aesthetic clinics, spa, traditional medicine, as well as specialty medical care. The patients or medical tourists usually seek out a satisfying medical tourism service based on quality of care, lower cost and convenience [5].

With the number of tourists rapidly increasing, the amount of resources consumed and wastes generated are increasing simultaneously. A stringent management strategy is needed to balance the effects of tourism as to maintain sustainability. This is the aim of this study; to propose a new framework for the sustainable development of medical tourism, while focusing on the current situation of Thailand.

In this study, the researchers are interested in the use of the Enterprise Architecture concept to develop the new framework as it has the ability to

capture the entire industry. It is a challenge to merge medical tourism and sustainable medicine in order to create green medical tourism. The main idea of health management should, however, be based on the World Health Organization's recommendations.

1.1 Enterprise Architecture (EA)

The approach with which the researchers expected to solve the fragmentation of the industry is through Enterprise Architecture (EA). EA is an appropriate approach for responding to the rapid changes within the industry by adding the aspect of technology to support the medical businesses. EA has been introduced as a management strategy, and is well known as the procedure for linking technology to businesses and policy alignment. EA provides a conceptual blueprint with a target structure. It identifies business needs and captures the whole enterprise. The scope of EA is not restricted to one enterprise, but extends externally and also to value chains. The benefits of EA involves the improvement in decision making, business transformations, and innovations [7, 8].

There are many EA frameworks and methodologies, however the main concept is to classify the target outcomes or the business vision. It leads to policy alignment, transparency and governance. The analysis between the current situation and the desired targets is a critical process. After the gap is identified, the plan and roadmap would be delivered via the EA methodology. The architecture divides the details into domains, layers, or perspectives. In practice, the EA framework like Zachman [9] helps to understand the fundamental structure of the enterprise by presenting it in a two-dimensional manner, with six participants and six views. The columns present the participants as the owner, planner, designer, builder, implementer and user. Interrogative expressions are filled in the corresponding rows to present the data (What), function (How), network (Where), people (Who), time (When) and motivation (Why). The Open Group Architecture Framework (TOGAF) provides the toolkits such as a checklist, and a guideline to develop an EA plan, which focuses on the major components of an enterprise. The four main layers consist of business, data, application and technological architecture [10]. A federal enterprise architecture framework (FEAF) is another framework which is used for sharing information among the U.S. federal government and in creating interoperability [11]. Moreover, there are certain issues in regards to the components of EA that should be considered such as monitoring, performance measurement, risk management, and regulatory compliance [12].

2 Related Works and Literature Review

Our study's objective is to introduce medical tourism with a sustainability framework through the EA approach. We started with a review of related works via a systematic review process. We performed the review of publications from 2014 to 2018, which are in English (or Thai for government documents). The search protocol had been developed based on the sustainable medical tourism EA model. The search keywords were listed as medical tourism, sustainable medicine, and health EA. The synonyms were also used in the search process to increase coverage, where green was used for sustainability and health/healthcare, and wellness for the medical industry. We selected databases that covered health systems, hospitality and management. The selected databases were extracted from PubMed (Medline), ScienceDirect, and Google scholar. Moreover, other relevant information were also searched and retrieved from various sources such as government reports, official reports, online articles and news. The titles and abstracts were first screened. The inclusion criteria were planned/unplanned travel, and all facets of national medical tourism including policies, ethics, law, finance and management. We excluded suicidal tourism and specific medical interventions such as surgery, stem cell therapy and organ transplantation.

EA requires core components as a guideline in the design process [13]. The core concepts were identified from literature. In addition, other requirements were also extracted from national policies and government documents. The requirements were analyzed and integrated to develop core components of the framework. The conceptual framework was drafted using the i* model to approve the components [14]. The blueprint of Thailand's medical tourism framework was then finalized.

2.1 Medical Tourism

Medical tourism is complicated by financial, legal, and ethical issues, as well as by health-related risks. Most common medical tourism are related to dental care, cosmetic and elective surgeries. Medical tourism is not directly related to treatment, but extends to cosmetic, wellness, spa, and traditional alternative therapies. It can be a planned or an unplanned trip. According to the previous conceptual framework for medical tourism, policies consisted of governance, regulations, delivery, human resource and financing [2]. The common characteristics of medical tourists are long-term stay and the willingness to pay. The financing aspects for medical tourism are insurance and out of pocket payments. The World Health Organization recommends

that the medical institutes must deliver appropriated services under legal and ethical guidelines. Medical resources must be distributed with equity for both international and resident patients. The medical specialists must have the capacity to handle and maintain the quality of services and treatments. The healthcare provider and staff are a significant factor in Malaysia [15]. In the same way, the healthcare workforce, health insurance and the international accreditation have been confirmed to have great impact on medical tourism in Jamaica [16].

The key drivers are technology, better quality of care, accessibility, and cost saving [17, 18]. Accountability should be definitely defined in relation to response for patient safety, system management, and patient follow-up. The regulations include the international standard and quality control such as JCI. The provider requires to maintain a standard procedure by receiving an international accreditation or quality guarantee to assure the tourists of excellent services [19]. There are also concerns of safe and secure environment such as food hygiene. The provision of health information should be comprehensible and of high quality, and should be easily accessible. Interpreters may be needed to overcome communication barriers. Websites, mobile applications and the airport counter services are some of the basic communication channels for information. Other influential factors include disease conditions, legality, marketing strategies and cultural barriers [18].

There are also risks to be considered in regards to cross-border transmission of infections, pathogens, and drug-resistant disease agents [20]. Medical reconciliation is a challenge to ensure the continuum of care. Accessibility and services should be provided between medical traveler's home and healthcare facilities. Health information (or medical record) disclosure overseas for transferring patients is a required process for interoperability. The patient's privacy and confidentiality are important. Furthermore, tourists must be informed about how to prepare themselves for potential endemic diseases at the destination area such as pre-visit vaccination, possible traveler's disease, and climate conditions [21].

In summary, the success factors for medical tourism are multidisciplinary collaboration, simplicity and accessible services, which include the availability of sufficient amount of information via global marketing. The researchers can merge the related components in medical tourism through good governance, ethics/regulations, service delivery, standardization/accreditation, competent healthcare staffs, financing/insurance, and information and technology.

2.2 Sustainable and Green Medicine

The sustainability of health is a process of strategic planning with the goal to produce healthier communities by developing quality health infrastructures. It requires responsibility, agreement, and accountability as the pillars. The policy support is determined as a necessary factor to integrate health promotion and the visions of sustainable development [22].

The concept is a complex of health, social dynamics, lifestyle, pattern of consumption and the bio-physical environment [23]. Hence, the green healthcare covers a scope of prevention and wellness. Lifestyle modification and diet control are cost-effective in reducing the risk factors of poor health and in maintaining a healthy condition, resulting in saving the overall healthcare resources. It is different from conventional medical practices for disease and illness. Environment is, however, an external factor that can also impact our health status. The integral methodological pluralism was purposed for green and healthy hospital framework [24]. The framework recommends a consideration of factors that can effect health status such as physical fitness, mental health, emotional well-being, cultural influences, social structures and environmental factors. This model extends to create a healthy workspace for healthcare professionals as well. The healthcare infrastructure should be built using sustainable technologies and operate with energy conservation and responsibility such as waste reduction, recycling, lower CO₂ production, water conservation and pollution prevention [25, 26]. Changing of work habit to lean processes is an important activity to create green healthcare. All the changes are under the patient's rights. For example, the take-back policy of unused medication can prevent the use of expired or degraded products. Physicians are encouraged to prescribe just enough amount of pills to reduce unused medication, save direct hospital costs, and also indirect costs in disposing hazardous products. Moreover, the economy is also considered as part of equity and sustainability as it has a direct effect on resource consumption. The demand of health services in general can also be reduced through the promotion of healthy living, which could also minimize the impact of illness [26].

In summary, the key factors in a sustainable health system focuses on disease prevention, health promotion, and habit modification to create a healthy community.

2.3 Health System and EA

A health system, according to the WHO health management framework, consists of service, workforce, information, essential medicine and financing [27].

EA has been proposed to integrate a health viewpoint and an IT alignment. The goal of a health information system is interoperability in communicating between systems, which includes interaction, service, and data/information exchange. The heterogeneous systems should comprehend each other. The National Institute of Health (NIH) identified the health EA components as the business, the information, and the application. However, the system should support agility, security and reduce technical risks [28]. Technology is considered as another element in the eHealth project. E-healthcare related projects also require the interoperability standard for sharing information across multidisciplinary divisions and organizations. In the architectural sector, the design of data standard, security, and management is recommended for a technological innovation.

The outcomes of interest which have been recommended by WHO are the change in knowledge, attitude, physiological and behavior. These are intermediate outcome and evaluated by the questionnaire, interview and self-report [29, 30]. Other interests are productivity, measurement of well-being and event rate, healthcare finance and organization change [30]. The incident rate is the common indicator for health program initiative [29] and the resource allocation is used for the policy-maker [31].

2.4 Related Documents and Policy

In this section, the researchers focus on Thailand. The medical hub has been pointed to the industries, which have to be advocated by the Thailand 4.0 digital policy. Thailand has planned a timeframe for the medical hub from 2016–2025, particularly focusing on 4 areas as follows; wellness, medical services, academics and products [32]. Thai herb products is one of the targets to be pushed in the market, both locally and internationally. Thailand has developed the first master plan on the Thai herb market since 2017. The strategy covers both industrial production and market development, then to promote the use of the products for health and treatment via health service management and policy strengthening.

Healthcare professionals are registered by specific professional bodies such as the Medical Council, the Pharmacy Council, the Nursing and Midwifery Council, and the Dental Council. The license requires renewal with a credit system to ensure the maintenance of quality and knowledge.

In short, to build the trust, providers should offer a great service, consistency and governance. Health organizations would rather have a standard in achieving the medical hub goals. As mentioned earlier, the

Joint Commission International (JCI) is a well-known international accreditation body that provides a strong criteria and standard to uphold, with a very strict review system [33]. In Thailand, there are local healthcare accreditation (HA) institutions and advanced HA for more comprehensive auditions. The standard checks for all aspects of a healthcare system, from services, to procedures, equipment, infrastructure, environment, staff and management [34].

3 Framework Development

The proposed framework is created by integrated process based on the EA methodology, shown as Figure 1. The framework is not a process model. Evaluation of the business and goal setting are EA principal. The current situation (AS-IS) is essential step of the design. TO BE or target architecture is designed according to the vision. The imperative change process needs the requirements and resources assessment. SWOT analysis, which is a common analytical tool for strategic planning and policy implementation in various kinds of businesses, is adopted as a tool to investigate current situation of Thailand. Then, the requirements of sustainable medical tourism are analysed. We designed the pre-conceptual EA framework using the i* model for viewing the overall system process. The i* model is used in presenting the relationship between entities. Actors are presented as nodes, and are dependent upon the relationship between the actors. The i* model contributes to the visibility of the information [35]. This model to help us for understanding the main resources and information flow within the enterprise at an early stage.

Figure 1 The EA method concept.

Figure 2 Sustainable medical tourism framework development.

Figure 2 illustrates the mechanism for developing the medical tourism enterprise architecture framework. The framework is developed and evaluated by using expert in-depth interview and the content validity index (CVI). Expert in-depth interview is the qualitative research method to extract the knowledge from the specialist on specific field. The CVI is calculated for each component and demonstrate the agreement [36]. The EA specialists are selected to perform the acceptance of framework component. The expected outcomes or index are presented by the mathematic simulation.

3.1 The Summary and Conceptual Mapping

Referring to related works and reviews, a multidisciplinary approach is favored in gathering and managing information on medical tourism. The main components for the conceptual framework should consist of five domains, including policy, standard, technology, health service delivery, and staff/workforce.

First, the policy manage multiple stakeholders, establish cooperation and create interoperability between local organizations and across countries. Second, standard and regulations must be upheld according to the disciplines of both local and international accreditation bodies. Integration between tourism laws and healthcare regulation is another important topic that need to be considered. The standard includes health information and the communication of the health information in transferring medical records, and in the protection of fragmentation. Third, technology support is required for services and activities. It allows for the provision of accessibility and connectivity. Health providers should offer good health services and prefer

Figure 3 Enterprise Architecture and concept mapping.

wellness or preventive activities over treatment for patients and the general population. Traditional medicine and herbs have been incorporated as part of the service by many healthcare providers and are in continuous development. Fourth, the service delivery must be accredited, which has high quality and safety. Medical infrastructure and processes should follow the sustainability policy and concept. IT innovation should support the lean process and reduce resource consumption. The last domain is the incorporation of qualified staff and workforce. Training and knowledge management is essential for all staff members to ensure service quality and a channel to earn the customers' trust.

A summary of the feature components are entered into the EA layers as shown in Figure 3. The layers are defined as business, application, data, and technology architecture. Policy alignment is ascribed as the top of the architecture.

3.2 The Review and Analysis of the Medical Tourism Business

3.2.1 The SWOT analysis of Thailand's current medical tourism situation

3.2.1.1 *Strength*

Thailand is well known as one of the best tourist destinations in the world. There are stunning natural sightseeing locations, with its exotic beaches and unique cultures. Food is certainly an attraction, with a range of dishes enriched with herbs that have an antioxidant benefit [37]. Thai people are welcoming and kind. The lower cost of living allows for reasonable prices

than western countries and other ASEAN countries such as Singapore and Malaysia. The pharmaceutical industry in Thailand is also recognized as one of the most advanced and developed in Southeast Asia, with high capability for innovation and development of new products, especially Thai herb [38].

In terms of the medical industry, the healthcare providers offer quality services. There are more than 50 hospitals that have been accredited by the Joint Commission International (JCI) [6]. JCI sets an international gold standard by acting as a standard regulator, advising and facilitating healthcare organizations towards a better performance and outcome [33]. There are many physicians and healthcare professionals that have been trained and certified from the U.S. and Europe. This information indicates a world-class medical service quality.

In addition, the Thai government has also driven forward medical tourism via the medical hub policy, with numerous multidisciplinary government support and cooperation [39]. For instance, the Tourism Authority of Thailand has provided worldwide digital marketing and media campaigns for promoting the Thai medical service. A visa with a medical purpose is validated for three months to one year depending on the treatment duration. Visa on arrival is also available. The long-stay visa has been extended to 10 years for foreigners aged 50 or older [40]. These national policies creates great opportunities for businesses. Nonetheless, a lack of specific standard and regulation are certainly issues of concern.

3.2.1.2 Weakness

A tourist patient referral system, which is required for planned treatment trips and emergency is still unavailable to reduce the fragmented data or to curb the poor follow-up problems and support long-term care. Health information or medical records should be transferred from hospitals in their countries under the standards for privacy and confidentiality.

Communication barrier is also common. In Thailand, the Thai language is the official language. Although most people can speak and understand English, it is limited only to the city areas. Language problems, however, is not such a significant problem anymore because of the digital age. The translation applications such Google translate are able to break the problems both textually and vocally. Public transportation in some areas can prove to be inconvenient, forcing the responsibility onto the private sectors. There are, however, logistic providers available.

3.2.1.3 Opportunities

Due to the excellent policies in relation to health promotion and prevention by the Ministry of Public Health (MOPH) in 2017, the hospitals under the MOPH are regulated for sustainable and ecological sanitation. This strategy focuses on creating a better health environment to develop ‘Green and Clean’ hospitals. The Green and Clean hospital strategy has facilitated the creation of a hospital network with leadership and inter-hospital communication. The goals are to achieve health benefits for both the provider and patients, minimize environmental consequences, and create awareness of the greenhouse effects caused by certain activities. These activities involve the (mis)management of garbage collection, rest room cleaning, energy generation, hospital environment cleanliness and general nutrition. The hospitals should also develop activities to promote health through physical exercises, nourishing cooking recipes, and restroom cleanliness [41]. The strategy indirectly supports preventive medicine and health promotion. The ‘preventive’ activities are part of wellness programs in medical tourism. It is also a good opportunity for extending the medical tourism market to government hospitals.

There is still a shortage of qualified healthcare professionals. The Thai Medical Council (or other profession councils) do permit foreign professionals to work in Thailand once they pass the national examination. It is an open opportunity to have talented professionals work in Thailand.

3.2.1.4 Threats

There are also certain existing high risks associated with traveling, which includes travel-associated disease outbreaks or disease dissemination, which have frequently been reported [42]. Prevention procedures and infection control are critical to limit the possibility of spread via tourism. Finally, unstable political status can have a large effect on the decisions of the tourists.

In summary, Thailand has many tourism associated strengths as well as are endowed with plentiful natural resources. Moreover, quality staff, advance technology, affordable prices and unique cultures are definite attractions. The weaknesses faced by Thailand are language barriers and perhaps distance barrier for tourists from some countries. Many national policies are now being modified to provide opportunities that will support the medical tourism program. The competitive nature of the industry, perhaps from other ASEAN countries, requires Thailand to constantly maintain its standards. The unstable political status of the country is also an issue of concern. Figure 4 demonstrates the SWOT of Thailand medical tourism.

Figure 4 The SWOT of Thailand medical tourism.

3.2.2 Requirement analysis: Relationship and dependency

The i* model is adopted for early analysis of requirements and stakeholders. This approach supports understanding of the relationship in the business and describes AS-IS situation. The requirements come from the proposes, activities, needs and the relationship between actor. This relationship and the process are based on Thailand's current situation. The entities are components from Figure 3. The major stakeholders or the actors are identified as tourists, travel agencies, healthcare providers, and health insurance companies. The government is a supporter. The stakeholders administer the requirements for the system, which then drives the business architecture.

The dependency and relationships are illustrated in Figure 5. Information is taken into the system for the tourist patients to plan and make decisions through various marketing strategies such as combination/promotional healthcare programs. The tourist actor will contact the tourism agencies (or related businesses such as transportation booking agencies, accommodation services and visa centers) to reserve and prepare the trip, or manage the planning and bookings themselves. When they arrive at the destination, the patients will depend on the physicians (or healthcare staff) for treatment and healthcare services. At this step, the medical and personal information, which include medical records, will indicate the system efficacy and reconcile with previous treatments. The resources in this situation are considered as health record,

Figure 5 The relationships within medical tourism.

drugs and herbs. The information should be provided concurrently with the medical service via verbal communication or via documentation. This service may be completed with payment or insurance claim. Qualified staffs are controlled via the acquisition and renewal of licenses to ensure knowledge and skills. Auditing also occurs on an annual basis to ensure a standard of services. The natural resources in traditional medicine are classified as herbal products and spa related treatment products. An actor within a drug company or a research organization would take responsibility to conduct research for product development.

After we illustrated the relationships within the area of medical tourism, it confirms that a standard is important in data and information sharing, especially health information that will be used for the purpose of treatment. This model ensures that the sustainable medical tourism framework follows a standard in terms of information sharing, service delivery, qualification of staff through a multidisciplinary approach, and a technological support. All components have to align with the healthcare policies and comply with the law.

Figure 6 The conceptual framework.

In this step, we can develop the conceptual framework (shown in Figure 6) which consists of the four major domains that align with the healthcare policies. The stakeholders is an essential element in understanding the enterprise, in accordance with the i*model and the Zachman framework [9]. The control block includes the standard, regulations, and auditors that are indicated for monitoring each component.

3.3 A Sustainable Medical Tourism Framework Development

The conceptual framework is broken down and shown in Figure 7. Target of medical tourism is the wellness and healthy community. The green healthcare focuses a scope of health promotion and prevention, environment, cultural and healthy workspace. The interoperability is the main idea of data and technology layer.

3.3.1 Leadership

The healthcare policies and government campaigns are put into the leadership layer. The rest of the components also have to align with the policies in accordance with the EA principles. The government has already initiated a plan for the Medical hub goal with Thailand 4.0 digital policy and sustainable development being the country's big vision. MOPH and the Tourism Authority of Thailand (TAT) have taken responsibility for the leadership.

3.3.2 Medical tourism business

The health service delivery and staff/workforce are the key components within the business layer. Service quality is directly dependent on staff competency.

Focusing on medical tourism, the health insurance, health promotion and disease prevention are significant because of two reasons. First, the

*Medical Hub, Thailand 4.0 and sustainable development

MOTS=Ministry of Tourism and Sport, MDSES=Ministry of Digital Economy and Social,
 CRO=Contracted Research Organization, GMP=Good Manufacturing Practice,
 ICH-GMP=International Council for Harmonization-Good Clinical Practice,
 HIPAA=Health Insurance Portability and Accountability Act.

Figure 7 Thailand's sustainable medical tourism Enterprise Architecture.

target customer are both healthy people and patients. Second, the area of sustainable medicine is related to preventative medicine and supports a wellness community. Thus, a healthcare business, especially medical tourism, should be changed from caring for the sick to preventive and holistic care.

We can describe the business layers in Thailand as follows. The private hospitals and some government hospitals have the potential to take care of the tourist patient with qualified staff and accredited facilities. Thai traditional medicine such as herbs, specific food and massage therapy have the capability to serve as a treatment and preventive care. Clinical research in herbal medicine has always been an ongoing division in order to further the development of the field, and to ensure quality and safety. Research and education are also critical in supporting services and strengthening the quality of the workforce. In addition to green healthcare, lifestyle modification is also preferred. Providers follow lean management for optimal resource use and waste minimization. For example, biodegradable products are chosen over non-biodegradable

products. Physicians are encouraged to prescribe optimal amount of pills (no extras). Physical therapy and exercise services, along with healthy food are provided within health promotion packages. Wellness and aesthetic services are also a target of Thai medical tourism. Referral/transfer system for patients from their home country also make for a continuing system of care. It is require the technology to exchange and communicate the health information.

TAT has promoted Thailand internationally, and has presented the quality of medical services and products in the foreign markets. Tourism agencies have also developed campaigns to boost the market. Healthcare organizations also promote special packages through marketing strategies and patient relationship management. Being a partner with a hospital certainly has competitive advantages. However, the social media and digital-marketing are also useful tools.

Many studies have indicated that tourist patients are at risk of infections. Resistant or uncommon pathogens from travelers may be transmitted to other patients/tourists during the treatment or travel period. Special infection control and screening protocol should be assured. A system-wide database or a travel related disease information system is required for tracking the incidences of infection, and the outcome of the medical evaluations [42].

The green healthcare policy has been implemented by MOPH. It increases awareness of the environmental effects and focuses on well-being. Green engineering is used for changing the processes and infrastructure. The lean process has been shown to increase patient satisfaction, while allowing a cost saving benefit.

3.3.3 Application

Technology is a supportive tool and an application is indirect driver of the system to offer comfortable service to tourist patients. The application is an intermediate in the process of communicating and interfacing between the patients and the healthcare provider. The interface can help in management and the simplification of tasks. For example, a patient e-portal allows patients to access their healthcare records and contact the staff. The hospital information system is primarily used for patient management. The application promotes the accessibility of the information, and thereby, improves the relationship.

3.3.4 Data (and information)

Digital disruption has allowed all information to be digitized, including health information. The specialists recommended that the data have been transformed to the big data. The hospital records, personal health data, biometric data,

research evidence and immigration records that are required for systematic data processes. Extended IT capabilities has allowed people to participate in healthcare with accurate data, while permitting a two-way communication channel. To reduce data fragmentation, technology with a communication standard should be applied. Medical data are exchangeable under the law, with the placement of firm security and privacy rules. Laws like HIPAA [43], should be complied with. International Telecommunication Union (ITU) recommends criteria for a communication standard and regulation, including e-health, to support a worldwide information network [44]. Likewise, the electronic health standards given as Health level Seven for health data communication and DICOM for medical imaging data management should be adopted to ensure data quality and interoperability [45].

3.3.5 Technology

The infrastructure must support the connected environment. The cloud technology has widely adopted in healthcare. The new blockchain technology can improve the security and support the health insurance. The internet of things and wireless network become basic infrastructures. Medical devices and personal devices are also increasingly being used as part of the health-care system. Telemedicine certainly has benefits on patient follow-ups and consultations. Data/information in the system should be stored at a national health data center for Thai citizens and archived as medical history for international patients. The government assumes this responsibility in accordance with the digital policy.

3.4 Framework Evaluation

The evaluation was divided into 2 part shown in Figure 8. First, the experts panel discussion was conducted to fulfil the framework. The EA specialists are expert in the field of medicine and technology. The quantitative evaluation

Figure 8 Framework evaluation.

method is the content validity [36]. The item relevance is computed by these content experts. The researchers requested the five specialists to score the completeness and the agreements in each layer. The scale was constructed on “not agree” to “strongly agree”. The item content validity index (I-CVI) was calculated from the number of experts giving the agreement. I-CVI with acceptable content validity should be more than 0.8 when the number of experts is five [46, 47]. We also reported the kappa statistic [48]. It is the consensus index which adjusts for chance agreement. The probability of a chance agreement (P_c) and Kappa calculated from the Equations (1) and (2), respectively.

$$P_c = [N!/A!(N - A)!] \cdot 5N. \quad (1)$$

Where, N= number of experts and A= number of experts giving the agreement.

$$K = (I - CVI - P_c)/(1 - P_c). \quad (2)$$

The second one was mathematics and the case study. The expected result is an index for helping on health budget estimation. EA framework is mainly proposed to serve the policy-maker perspective. The scope of sustainable medicine and medical tourism are health promotion and prevention. The evaluation is dependent on many factors including the strategy planning, implementation and budget [29]. Therefore, the health financing is considered for accountability objective. The researcher adopted the WHO recommendation 2 in health promotion evaluation for the policy-maker that financial resource. The health financing should be allocated at least ten percent of health promotion initiative be appropriated to evaluation [31]. We developed the Equation (3) to compare the conventional and the sustainable medical tourism (shown in Figure 8).

$$\frac{\sum(C_{MT})}{C_{total}} > 0.1 \quad (3)$$

Where, C_{MT} is cost of medical tourism service for health promotion, prevention and activities given as infection control, traditional medicine etc. and C_{total} is the total health expenditure.

4 Results and Discussion

This framework contributes the new concept in sustainable medical tourism. In addition with EA method support the better management especially for implementation planning. It is definitely a challenge to integrate sustainability,

medicine and tourism together. The EA framework that has been established requires strategic planning and structural transformation. The researcher has focused on the presentation of EA as a conceptual framework for medical tourism. The financing benefit of EA framework was discussed.

4.1 The Expert In-Depth Interview and Content Validity

The Thailand's sustainable medical tourism EA framework was successfully developed (shown as Figure 7). The evaluation results are shown in Figure 9.

We plotted the content validity, as shown in Figure 9. The components; policy alignment, business, application, data and technology are extremely valid and necessary for the framework ($Kappa > 0.8$) [47]. The framework is absolutely aligned with the medical hub policy, and is expected to lead to business transformation. Governance and transparency would also be delivered through the framework. It has also been established that preventive medicine is better than the use of resources in caring for the sick. The aspect of information exchange has still proven to be difficult in terms of complete implementation, however, it still stands as highly important and is indicative of system efficiency. Technology is accepted to support other component and drive the business. Telemedicine and communication technology have also been considered as a solution for patient follow-up to overcome the distance barrier. Technology improve the security given as Blockchain and biometric identification are satisfied. Technology and applications are the first portals of

Figure 9 Framework completeness and agreement.

contact with the tourists; therefore, they should be provided at all convenient points. The network infrastructure should also be improved to support the business service to achieve high quality. The stakeholder and the control are substantial agreement ($Kappa=0.61-0.8$) [47]. A multidisciplinary approach is required in every process. In conformation with the framework, all related staff members should be qualified, not just the medical staff. The organization need clear direction and action plan. The customer and stakeholder engagement should be concerned. Furthermore, the control is serious and need to revise. Protective laws for medical tourism need to be considered and developed.

4.2 The Case Study and Framework Application

The data sample was collected from the national health account in 2016. We included the cost from related health prevention and promotion service in business component. The variables are health prevention, health promotion, traditional medicine and infection control. The index would compare between conventional and sustainable medical tourism. The results was calculated from the Equation (3) and illustrated in Figure 10.

The result shows the sustainable medical tourism financing is increased than conventional. The Working Group has suggested 0.1 *is reasonable for the minimum acceptable for development and implementation* [31].

Figure 10 The index comparison between conventional and sustainable medical tourism.

This is an application of EA blueprint to assist the adequate resource allocation planning. The presentation is limited to the current situation in Thailand, with some advice having been provided by an EA specialist for the completion of the framework. It is certainly a useful tool/framework for researchers, practitioners and policy makers who work in the fields of medicine, health-care and tourism. There are no comparative results with data from other countries.

We also hope that this framework can become a basis of recommendation for other nations with similar characteristics. Moreover, WHO has reported the health statistics indicators for sustainable development goals and provided the standard of metadata, indicator set and estimation method [49]. It would be useful for conducting the qualitative evaluation tool.

5 Conclusion

In this study, the researchers successfully developed the Enterprise Architecture framework for sustainable medical tourism. The established framework is based on Thailand's vision of medical tourism and its related policies; therefore, the EA framework is designed as target architecture. The core components determined through literature review and government documents are classified as policy, standard, technology, health service delivery, and staff/workforce. The relationship and dependency of the components are brought about using the i*model and are then incorporated into the EA model. Moreover, key stakeholders and controls are already integrated. The components are confirmed and validated for the framework by qualitative and quantitative method. The most important factor is leadership as it provides the basis for policies and support, and for achieving set goals through governance. In the business layer, sustainable medicine and medical tourism have the same emphasis on health prevention and promotion of wellness. Medical professionalism and innovative treatment technologies are essential in providing quality services. In addition, with Thai traditional medicine incorporated into the policies, the healthcare business offered by the country would have a unique and valuable bearing compared to other competing countries. Other supported businesses such as research, insurance, logistics and marketing are considered and incorporated. This study has indicated that technology plays a significant role in interoperability for the communication system. Patient information, medical records or related personal health data are significantly important, and are required in the process of communication and information

exchange between facilities. An effective communication system allows for the provision of services in a convenient manner, and to create a continuation of care as patients and their medical information can be smoothly transitioned across countries. The laws and regulations is one of the standards that must be complied with in order to protect the rights of the patients, their privacy and their security. In order to achieve sustainability, EA encourages and permits better decision making and planning. The reprocessing of the business to a lean model is a matter of the framework.

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