The Success Factors for Digital Transformation to become a Smart Hospital: Case Study in Thailand

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***Abstract*—Technology has become a vital role in the healthcare industry as it helps to improve the efficiency and quality of care delivered to patients. This paper aims to identify the critical factors for the successes and failures in implementing a smart hospital in Thailand. We have conducted our research through semi-structured interviews with the top-managements of the hospital and experts in the smart hospital. Then we analyze our findings through the Thematic analysis to understand the critical factors within the industry. The results show that key factors, including the staff's readiness, leadership policy, epidemic, knowledge management, and collaboration among organizations, are essential to digitally transform toward the next smart hospital level.**

***Index Terms*— Knowledge Management, Leadership skills, Technology acceptant, Joint Commission International**

I. INTRODUCTION'

NOWADAYS, technology has become very common in daily activities, including in the healthcare industry. Technology will be helped in providing, developing, and improving the healthcare outcomes for service users due to greater access and efficiency in communication (written and verbal), patient consultation, investigations, diagnosis, and treatment [1]. Moreover, the efficiency of a hospital and quality improvement of care delivered to patients are things that hospitals pay attention to [2]. In a word, "smart hospital" [3] defines it that concerned with optimized and automated processes that help improve the efficiency of patient care. Similarly, the Ministry of Public Health of Thailand defines the definition of Smart Hospital as a government hospital under the Ministry of Public Health uses the application of digital technology to support the provision of services within the hospital to reduce the procedure and for quick convenience in receiving good quality service be safe and modern, environmentally friendly. Therefore, the Ministry of Public Health has arranged the smart hospital project, based on many hospitals in Thailand are facing a patient problem. The amount of overflow patient which causing patients to wait in a long line, payment and dispense is delayed. Moreover, medical personnel are not enough to provide services. Therefore, the technology has begun to be applied, aiming to develop work and management processes in the hospital using technology. A smart hospital project comprises 5 levels, including smart place, smart tools, smart service, smart outcome, and smart hospital.

The characteristic of a hospital at the smart hospital level are as follows. First Smart place, the hospital operates on environmental health. Passed the GREEN & CLEAN Hospital operating criteria of the Department of Health and decorated the place to be beautiful Modern look (Digital Look) increases the convenience and speed of receiving services. Second, Smart tools, Hospitals use digital technology to increase service efficiency by providing automated medical equipment and devices Queue Management System. Third, the Smart service, the hospital has efficient process management consistent with development and organization according to the Digital government development plan of Thailand by canceling the request for a copy of the ID card and other documents issued by the government from patients and change to use Electronic Medical Records (EMR: Electronic Medical Records. Forth, Smart outcome: The hospital has a management system to be connected automatically using the ERP (Enterprise Resource Planning) system. Lastly, Smart hospital: The hospital is efficient in managing and has the unit cost in the appropriate criteria that can be compared. (Benchmarking) with other agencies. There is good proactive risk management in all dimensions. To provide good quality service in all dimensions and to conserve the environment and sustainable energy conservation.

The purpose of this study is to examine the factors that affect the smart hospital level. The main focus is on knowledge management, leadership skill, technology acceptant, and Joint Commission International (JCI), which can upgrade smart hospital levels.

II. LITERATURE REVIEW

This section reviews 4 mains factors that are affecting upgrading smart hospital level. The factors include a literature review of knowledge management, leadership skills, technology acceptant, and JCI.

A. Knowledge Management

Knowledge management (KM) is a function of management that creates or locates knowledge, manages the flow of knowledge, and ensures that knowledge is used effectively and efficiently for the long-term benefit of the organization

[4]. KM combines various concepts from numerous disciplines, including organizational behavior, human resources management, artificial intelligence, and information technology [5]. [6] suggested that knowledge management supports innovation, new ideas, and the exploitation of the organization's knowledge. KM also allowed easy access to know-how. KM further allows collaboration, knowledge sharing, continual learning, and improvement. Thus, KM includes essential organizational activities. It can enhance a firm's productivity and other key performance measures [7]. [8] suggested that knowledge management activities are essential to a firm's success. In addition, KM can effectively facilitate learning and the exchange of individual expertise and experience between professionals and, in turn, improve the quality of care and profitability [9].

B. Leadership Skills

Many authors have highlighted the role of leadership in the success of quality initiatives. [10] has classified leadership skills into 4 main groups: cognitive skill, Business skill, Interpersonal skill, and strategic skill. In each skill have details as following

1) The cognitive skills are needed by executive leaders to understand the required complex behavior of patterns involving creative thinking, decision making, and strategic problem solving [10].
2) Interpersonal skills, which are defined as "goal-directed behaviors used in face-to-face interactions, to bring about a desired state of affairs" [11].
3) Business skills include organization, negotiation, and managing personal, financial, and material resources [12].
4) The strategic skills are associated with conceptualizing the organization's mission and vision [13]. The leaders and followers in this type of leadership style are based on returning rewards or incentives in response to the appreciable performances of employees [14].

Leadership skills in knowledge, skills, and attitudes are essential parts of a hospital effectively and efficiently.

C. Technology Acceptance

Acceptance is a perceptual phenomenon that involves evaluating new experiences and arriving at a final decision concerning the benefits and limitations of that experience. Acceptance outcomes are derived from attitudes or courses of action. Acceptance is an unpredictable construct because modified perceptions or general conditions can lead to different levels of acceptance. Accepting or rejecting a specific technology depends on various influencing factors [15]. They are four predictors of behavioral Intentions to use a new technology

1) Social influence referred to the degree to which individuals perceived that significant other, such as family and friends, believed they should use a technology [16].
2) Performance expectancy was defined as an individual understanding of the advantage of using a technological innovation that results in better outcomes [17].
3) Facilitating conditions are defined as the degree to which an individual believes that an organizational and technical infrastructure exists to support the use of the system [18].
4) [18] define effort expectancy as the level of convenience associated while using any system. The effort expectancy refers to the effort needed to use the system, whether simple or complicated. According to [19], effort expectancy is a highly significant factor influencing intention to use.

[20] suggests the significant effect of hospital personnel's behavioral acceptance of technology, including usefulness, ease of use, social influence, attitude, facilitating conditions, and self-efficacy. In addition, training is one factor that impacts behavioral intention to accept new technology.

D. Joint Commission International

Joint Commission International (JCI) is an independent, nonprofit organization. JCI identifies, measures, and shares best practices in quality and patient safety worldwide. The mission of JCI is to continuously improve the safety and quality of care in the international healthcare community through education, advisory services, and international accreditation and certification. JCI is a perceptual phenomenon that involves evaluating new experiences and arriving at a final decision for the benefits and limitations of that experience. The JCI has more than 100 countries partners with hospitals, clinics, academic medical centers, healthcare systems and agencies, government ministries, academia, and international advocates to promote the standards of care and provide a solution for achieving the performance for healthcare providers. JCI standard contains the leading standard, and sub-stratum standards for each area [21] explain the Patient Center Standard and Healthcare Organization Management components. In part of Patient Center Standard addresses the total of 8 elements. First, International Patient Safety Goals (IPSG) as an accreditation. The purpose of the IPSF is to promote specific improvements in patients' safety. Second, Access to Care and Continuity of Care (ACC). The target of ACC is to improve patient care outcomes and more efficient use of available resources. Third, Patient and Family Rights (PFR), the gold of this standard is to provide considerate and respectful care that promotes and protects patients' dignity and self-worth. Fourth, Assessment of Patients (AOP), the goal of assessment is to determine the care, treatment, and services that will meet the patient's initial and continuing needs. Fifth, the Care of Patients (COP) is the crucial responsibility to provide safe and effective care and services to all patients. Sixth, Anesthesia and Surgical Care (ASC) require complete and comprehensive patient assessment, integrated care planning, continued patient monitoring, and criteria-determined transfer for continuing care, rehabilitation, and eventual transfer and discharge. Seventh, Medication Management and Use (MMU) primarily concern processes that support safe and effective medication use. Lastly, Patient and Family Education (PFE) will help patients better understand and participate in their care and make well-informed care decisions.

Part of Health Care Organization Management Standards includes 6 mains components. First, Quality Improvement and Patient Safety (QPS) provides quality improvement and patient safety that impacts all aspects of the facility's operation. Second, Prevention and Control of Infection (PCI), The goal of an organization's infection prevention and control program is to identify and to reduce or eliminate the risks of acquiring and transmitting infections among patients, staff, health care practitioners, contract workers, volunteers, students, visitors, and the community. Third, Governance, Leadership, and Director (GLD), In all GLD standards, indicate the expectation found in the standard. Fourth, Facility Management and Safety (FMS), this standard provide

safe, functional, and support facilities for patients, families, staff, and visitors. Fifth, in this standard, Staff Qualifications and Education (SQE) are looking through the skilled, qualified people to fulfill its mission and meet patient needs. Lastly, Management of Information (MOI) improves information communication with patients and their families. A healthcare organization can apply for each accreditation by themselves for upgrading high standards in healthcare delivery and achieve care excellence [22]. In addition, to improve the structure and process of healthcare services, delivered, and clinical outcomes, the standard in each area under JCI, is an indicator [23].

III. RESEARCH METHODOLOGY

In this study, we interested to know the factors lead to upgrading the level of smart hospital, we summarize of additional factor from interviews. The related factor is a suggestion and analyzed from the attitude of an expert who works for a smart hospital project. The experts are the deputy director, president of public health executive, head of nursing, board of director, and public health specialty.

We adopted semi-structured interviews. The interviewees were asked about the general information of their hospital, technology use in the hospital. In addition, the additional factors that led to upgrading to a smart hospital were identified from their perspective. Semi-structured interviews were conducted individually by face-to-face interview and a phone interview with a duration of about one hour for each person. Five experts were working on a smart hospital project for their hospitals in Thailand. All interviewees are in the position of management level. The interviewees are working in primary care, secondary care, and tertiary care. The different size of hospital is choosing due to the different critical factors for the successes and failures in implementing a smart hospital in Thailand. The profile of the five interviewees is shown in Table 1. The audio was recorded for later analysis.

Table 1 Interviewees' profile

No	Position	Work Place	Responsibility
1	Deputy Director	Samutprakarn Hospital	Responsible for the technology implementation plan in the hospital for leading to a smart hospital.
2	Head of nursing	Paolo Memorial Samutprakarn	Responsible for the hospital's policy on bringing technology to provide services to patients in the covid-19 epidemic and participating in the training nursing staff to review knowledge and gain new knowledge.
3	Board of director	Hua Plu Hospital	Responsible for the policy of entering into a smart hospital according to the Ministry of Public Health policy.
4	Public Health Specialist	Health Promoting Hospital	Monitoring the readiness of the hospital to become a Smart Hospital
5	President of Public Health Specialist	Association of Health Administrators	Responsible for guidelines for leading to a smart hospital and sharing guidelines among hospital chains under the Ministry of Public Health.

IV. RESULTS AND DISCUSSION

The thematic analysis offers flexibility and theoretical freedom and is comparable with the constructionist paradigm in examining the range of experiences within contemporary society [24]. This qualitative descriptive study used thematic analysis of semi-structured interviews with five experts working on a smart hospital project for their hospital in Thailand. The transcription and thematic analyses were performed. Five themes captured the main issue with upgrading smart hospital-level, including staff readiness, leadership policy, knowledge management, collaboration, and epidemic.

A. Staff's readiness

This theme is defined by cases no. 1, 3, 4 as concerns about replacing positions and staff that affect staff unpreparedness. Moreover, unfamiliar with new technology in the hospital was mentioned, and staff needs to attend and participate in the training.

Table 2 Thematic analysis (Staff's readiness)

Case No.	Theme	Code	Transcription
1	Staff's readiness	Unfamiliar	The hospital brings some machines to replace people in a routine process. Therefore, they have to prepare the replacement staff to move to other positions with which they are unfamiliar by training and experience about using the new system from colleagues
3			This hospital is a community hospital. We have a limited number of employees, both technicians, and non-technician. Therefore, one staff needs to do multitask and be unfamiliar with the hospital.

4			There are a limited number of employees in different sizes of the hospital. Therefore, staff will need to do an unfamiliar task.

B. Leadership policy

This theme is defined by cases no. 1, 3, 4 is a conglomerate of the problem of the policy from the Ministry of Health in each year and director position rotation which they have different policies. Therefore, it affects the continue the project based on the director's policy.

Table 3 Thematic analysis (Leadership policy)

Case No.	Theme	Code	Transcription
3	Leadership policy	New director	The hospital director position has short-term. The policy will be changed following the new leader's policy at that time.
4			The rotation of director when a new director comes, they will change a new policy. It caused of discontinuation of policy.
5			The new policy from the Ministry of Public Health will affect the policy from the hospital director.

C. Knowledge Management

This theme is defined by cases no. 1, 3, 4, which is a transfer of knowledge from supervisors and annual training for technician and non-technician staff to maintain and update the new medical knowledge or new policy from the Ministry of public health.

Table 4 Thematic analysis (Knowledge management)

Case No.	Theme	Code	Transcription
1	Knowledge management	Knowledge sharing	This hospital invite leadership in each department for training a new technology and lets them share their knowledge from training to other colleagues
3			This hospital provides annual training to maintain and update the new knowledge to their staff.
4			This organization provides the seminar and invites staff to join it to get new information and share their knowledge with colleagues.

D. Collaboration

This theme is defined by cases no. 1, 4 as a conglomerate of collaboration among hospital and public companies. A Corporate Social Responsibility (CSR) of a public company is submitted to assist in developing both process and system for the hospital.

Table 5 Thematic analysis (Collaboration)

Case No.	Theme	Code	Transcription
1	Collaboration	Collaboration with public company	Collaboration between hospital and startup company to develop a back-office system.
4			Some CSR policies of public companies are help hospitals in terms of building medical equipment, an automatic machine or assist in developing hospital systems

E. Pandemic

This theme is defined by case 1, 2, 5 is a conglomerate of the problem stemming from a pandemic of covid-19 which affect the patient visit to the hospital. The hospital will provide an online service to taking care of their patients without visiting the hospital to reduce the risk of infection during an epidemic.

Table 5 Thematic analysis (Pandemic)

Case No.	Theme	Code	Transcription
1	Pandemic	Effect of covid-19	The hospital provided telemedicine for taking care of Noncommunicable diseases (NCDs) patients to reduce the risk while patients visit a hospital.

2			The hospital provided an online VDO call check-up service without visiting the hospital. For those who want to consult a doctor or patients who need to take medication regularly without interruption. No need to come to the hospital
5			Many hospitals provide an online service for their patients to reduce the risk of the epidemic by using telemedicine, VDO call

From the finding of the thematic analysis, we obtained five additional factors to become a smart hospital. The factors include staff's readiness, leadership policy, knowledge management, collaboration, and epidemic.

Based on analysis from the interview, the rotation, short-term position of director will change a new policy while leadership policy that guides the hospital's operation, consistent with the literature review of [10] that is a leadership style in strategic skills which associated with conceptualizing the leadership policy.

The second factor is the staff's readiness. This is consistent with the analysis from the interview that the unfamiliar task. However, it is an unfamiliar task, but changing in the systems within the hospital was a driving force that made it possible to perform a new role similar to the literature review of [25] that readiness for change corresponds to social influence, which the staffs understand of the advantage of using a technological and intention from their colleague to use technology. As mentioned above, the staff's readiness is consistent with the technology acceptance theory.

The third factor is knowledge management. This is consistent with the analysis from the interview that there is an exchange and sharing of knowledge among personnel within the hospital. According to knowledge management could effectively facilitate learning and the exchange of individual expertise and experience between professionals and, in turn, improve the quality of care and profitability [9].

The fourth factor is collaboration, and the last factor is the pandemic. The collaboration and pandemic are two additional main factors that we obtained from the interview, which are the additional main factors that will likely lead to the development of a smart hospital. On the other hand, the main factor of Patient Center Standard and Healthcare Organization Management in JCI as well as Technology acceptance factors are not mentioned as one of the factors that will lead to the development of a smart hospital by five experts but in the previous literature review in patient-center standards such as [26] suggest that patient-centered can improve healthcare quality in smart environments in hospital. Moreover, [27] mention that user self-efficacy, top management support, compatibility, and information quality significantly impact perceived ease of use and usefulness in a healthcare organization. Lastly, [28] suggest that in healthcare organization management, issues related to the safety of the facilities, the quality of care provided to patients, staff satisfaction, and the costly ineffectiveness of workflows are the most important to improve the performance of the hospital.

Leadership in the hospital industry causes a failure in implementing a smart hospital in Thailand. However, in all the opposing sides, there was still positivity effect into another. On the other hand, staff's readiness, knowledge management, collaboration, and pandemic, causing the success to be a smart hospital in the viewpoint of substituting technology to continue working and reduce unnecessary processes in the hospital. By the way, they are a few initial challenges, but if they can improve and develop, they will reach a smart hospital (Figure1).

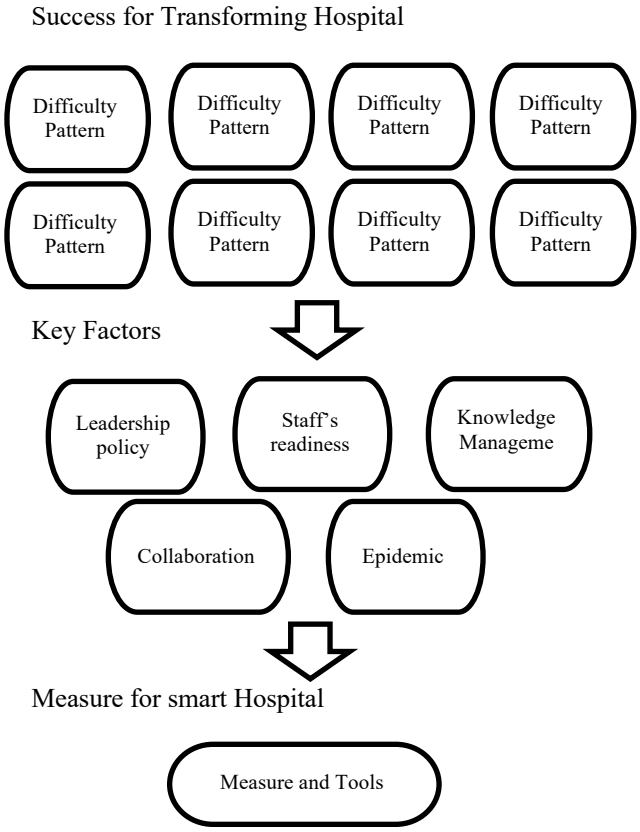

Figure1 Identification of key factors for transforming hospital

V. CONCLUSION

As technology will be helped in providing, developing, and improving healthcare service efficiency. We are interested in studying how to implement the success factors of transforming to a smart hospital in Thailand.

This paper aims to identify the critical factors for the successes and failures in implementing a smart hospital in Thailand. We have conducted our research through semi-structured interviews with five top-managements of the hospital and experts in the smart hospital. Then we analyze our findings through the Thematic analysis to understand the critical factors within the industry.

Five factors for upgrading toward a smart hospital were identified: staff readiness, leadership policy, knowledge management, collaboration, and epidemic. The first three factors, staff readiness, leadership policy, and knowledge management, corresponding to the literature review studied. In comparison, the other two factors, collaboration, and epidemic, were added to this study.

To succeed in transforming to a smart hospital, the staff

readiness, leadership policy, knowledge management, collaboration, and epidemic factors are essential for transforming to a smart hospital, and interested hospitals should prioritize the above factors as a guideline for appropriate hospital development.

The future study should fully develop the questionnaire survey and distribute it to the hospital under the Ministry of Public Health via postal mail, e-mail, in-person and online. The survey data should be confirmed empirically using the statistical analyses and the Analytic Hierarchy Processes (AHP). The multiple regression or Structural Equation Model (SEM) could verify the significant factors. Moreover, AHP could determine the ranking of these factors affecting the digital transformation in the hospital.

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