

**DIGITAL TRANSFORMATION IN HEALTHCARE: ACHIEVEMENTS,
CHALLENGES AND SOLUTIONS****Trinh Thi Thu Trang¹****Hoang Van Du²**¹Faculty of Economics, Thainguyen University of Economics and Business Administration (TUEBA), Vietnam²Training Center According to Social Needs, Thainguyen University of Economics and Business Administration (TUEBA), Vietnam**ABSTRACT**

Digital transformation in all areas of social life, especially in healthcare sector, is an inevitable trend today in the world as well as in Vietnam, including Thai Nguyen province, and has achieved good initial results. The article has collected secondary data sources and used statistical, systematic, analytical and synthetic methods to evaluate the achievements, challenges and solutions of digital transformation in healthcare in Thai Nguyen province. This paper evaluated the achievements as well as limitations in the process of digital transformation in healthcare in aspects of digital institutional development; digital awareness development; digital economic development; digital society development and technical infrastructure development to serve digital transformation in healthcare. Based on the above analysis, the article has proposed the following recommendations: actively propagate and disseminate to raise awareness about digital transformation in healthcare; ensure the legal corridor and digital institutions in healthcare; develop a medical data integration platform; enhance people's access to digital health services and develop plans to ensure health information system.

Keywords:

Digital transformation, healthcare, Thai Nguyen, Vietnam

INTRODUCTION

The fourth industrial revolution is a major trend converging many breakthroughs digital technologies such as the internet of things (IoT), artificial intelligence (AI), big data processing, cloud computing, to implement super connection between the real world and digital space, deeply impacting all aspects of socio-economic life. Therefore, digital transformation to meet the needs of the times is an urgent need of each industry. The health sector, faced with increasing social needs, has carried out digital transformation, applying technology and communications in a comprehensive way to healthcare activities, in order to optimize information management and storage as well as improve quality, efficiency and user experience.

Not an exception to this trend, Vietnam in general and Thai Nguyen province in particular are also completing the digital transformation process, finding the most optimal solutions to successfully implement digital transformation in healthcare system and take care of people's health. Digital transformation in healthcare in Thai Nguyen province has been implemented synchronously, initially achieving some results that meet requirements in the new situation. The Health Sector has advised on the development and implementation of many programs, plans and projects such as establishing the Steering Committee for Digital Transformation in Healthcare; organize Digital Transformation Conference; Advise and submit to the Provincial People's Council to promulgate Resolution No. 147/NQ-HDND dated August 12, 2021 on approving the Project to develop smart medical information technology for the period 2021 - 2025 in Thai Nguyen province with the following goals: Building information technology infrastructure in healthcare synchronously, completely, modern, quality and effectively, meeting the needs of domestic and international integration; help people easily access and use basic health services, some high-quality services, and receive continuous, comprehensive, lifelong health protection; Decision approving the digital transformation healthcare program in Thai Nguyen province....

State management of the basic health sector is supported by information technology software applications to facilitate management, supervision, inspection and executive direction. Up to now, entire Thai Nguyen province has had 213 medical facilities connecting with more than 2.4 million records on the common system, more than 70% of the population in the province has electronic health records, over 560,000 accounts have installed electronic health books on smartphones. 100% of health insurance medical examination and treatment facilities look up health insurance information using citizen identification cards with electronic chips... However, the health sector in Thai Nguyen province is still facing many difficulties in some digital transformation activities as well as in the management of these activities such as: applying digital technology in professional activities; The ability to access IT application services for a segment of the population in difficult areas; the lack of technical and economic guidelines and norms on IT in hospitals; Infrastructure and equipment at some medical facilities are still lacking and inconsistent; The IT capacity of medical staff is still limited,... This study analyzed and evaluated the current state of digital transformation in healthcare of Thai Nguyen province, pointed out achievements, as well as difficulties and challenges; on that basis, proposed some solutions to enhance digital transformation in healthcare of the province in the coming time.

LITERATURE REVIEW

Digital transformation is the process of applying breakthrough technologies to increase productivity, create value and increase social welfare (Ebert and Duarte, 2018). Healthcare includes all services provided to maintain and protect human physical and mental health, and is one of the important industries where digital transformation has emerged (Marques and Ferreira, 2020). The digital revolution in healthcare created new opportunities and business models to solve problems in healthcare, and other related issues such as population aging (Elton and O'Riordan, 2016). Since 2010, the digitalization of healthcare has become inevitable (Lupton, 2017), and to date, the global healthcare industry has engaged in extensive digital transformation (Burton-Jones and al., 2020).

Digital transformation in healthcare sector includes the use of electronic record systems, mobile applications, management systems and advanced technologies. Many 4.0 technologies are applied to serve digital transformation in the healthcare industry such as cloud computing, artificial intelligence, Internet of Things, big data, food virtual reality/augmented reality (VR/AR)... In particular, cloud computing is the technology with the most patents mentioned, accounting for 33.7% of the total number of patents in this group. In second place is artificial intelligence, technology accounting for 25.3%; next is Internet of Things technology, accounting for 16.9% (CESTI, 2021).

Because health data is personal information and often sensitive, patients are highly concerned about how their data is collected, processed, and analyzed by their service provider and/or the third parties (Austrade, 2019). Developing sustainable IT infrastructure is one of the sustainable development goals (SDGs) and can become more reliable thanks to Blockchain technology (BC) and Internet of Things (IoT) (Chandan et al., 2023).

Research by YCP Solidiance (2020) shows that policies encouraging digital transformation and medical technology application around the world were created to achieve three main purposes: (1) empowering patients; (2) improve the quality of medical examination and treatment; and (3) reduce costs and increase operational efficiency. Not an exception to this trend, the Vietnamese government has also completed the digital transformation process in the medical system and people's health care (Vo Tat Thang et al., 2021). Digital transformation in healthcare brings many practical benefits including: Quick analysis of patient conditions; Improve medical service experience; Timely support patients; Eliminate manual data and information processing errors; Improve management efficiency and decision-making ability; Increase customers and profits; Security, ensuring the safety of all data; Monitor real-time patient information.

Dao Thi Lan Huong and colleagues (2022) analyzed three impacts of digital transformation in healthcare: the impact on leadership, management, and internal operations of the health sector; impacting the provision and access of medical services from traditional methods to digital technology platforms and affecting the way of working and communication of health sector staff.

It can be seen that studies on digital transformation in the country and abroad have stated the benefits of digital transformation in healthcare; Introducing modern technologies applied in the medical section in countries, including Vietnam. However, there has been no research on digital transformation of the health sector in Thai Nguyen province - one of the centers for training medical human resources and gathering many prestigious medical facilities in the Northern midland and mountainous areas of Vietnam. Therefore, researching the current status of digital transformation in healthcare in Thai Nguyen province is urgent, thereby proposing basic solutions to overcome limitations and promote stronger and more complete digital transformation.

METHODOLOGY

This study used information collection methods, descriptive statistical methods and comparative analysis. Secondary information about state management of digital transformation in healthcare were collected from official reports of the Department of Information and Communications of Thai Nguyen province, Department of Health of Thai Nguyen province and official websites.

RESULTS AND DISCUSSION

1. Achievements in digital transformation in healthcare in Thai Nguyen province

1.1. Developing digital institutions in healthcare

The Provincial People's Committee and the Department of Health of Thai Nguyen province have studied the system of State legal documents on digital transformation in healthcare, thereby developing an annual digital transformation plan as well as establishing a Steering Committee for digital transformation in healthcare in the province, using specialized networks in the operations of the Department of Health.

The Department of Health issued Plan No. 06/KH-SYT dated January 3, 2023 on Digital Transformation in healthcare and implementing the "Project for developing smart health information technology in Thai Nguyen province for the period period 2021-2025" with the goal of promoting the application of information technology to develop and achieve the goals in the health sector of Resolution 01-NQ/TU of Thai Nguyen Provincial Party Executive Committee on the Transformation Program for the period of 2021-2025, orientation to 2030.

The Provincial Department of Health has implemented the directive documents of the Ministry of Health, the Provincial People's Committee, and instructions of departments, divisions and branches on digital transformation. Digital institutional in health sector aimed to build a modern, quality, equitable, effective and internationally integrated local health system; Support people to easily access medical information to use highly effective medical services and to continuously protect, care and improve their health throughout their lives.

1.2. Developing digital awareness in healthcare

The health sector of Thai Nguyen province has promoted propaganda to raise awareness of management agencies, medical facilities, businesses, and communities about the role and benefits of digital transformation to improve the quality of medical examination and treatment, and serve the people. This is shown in the fact that 100% of units under the Department of Health have implemented digital transformation, deployed software applications for document management and administration, electronic one-stop shop, digitally signed electronic documents, digitized and digitally signed electronic one-stop records... Propagating the utility of Citizen Identification with an electronic chip integrated with Health Insurance card code and piloted medical examination and treatment covered by health insurance using citizen identification cards with electronic chips have also been continuously implemented in recent years.

The entire health sector has 522 officials participating in the comprehensive digital transformation knowledge and skills training course trained by Vietnam Online Academy Joint Stock Company (according to document No. 2954/STTTT-CNTT dated December 13, 2022 of the Department of Information and Communications on registration to participate in comprehensive digital transformation knowledge and skills training courses); Coordinated with the Department of Information and Communications and the Training Institute of Hanoi University of Science and Technology to organize 3 training classes "Improving skills in digital transformation" for leaders and health sector officials with a total of 3,144 people. participate (according to Plan No. 41/KH-STTTT dated May 16, 2023).

No	Training course	Number of training courses	Number of participants
1	Comprehensive digital transformation knowledge and skills	2	522
2	Improve digital transformation skills	3	3,144

Table 1. Number of training courses and training participants on digital transformation in healthcare in 2022-2023

(Source: Department of Health of Thai Nguyen province, 2023)

During the process of implementing digital transformation, the Provincial People's Committee has actively organized propaganda and dissemination of documents on the application of population data, electronic identification and authentication; Utility of Citizen Identification with electronic chip integrated with Health Insurance card code and piloted health insurance medical examination and treatment with Citizen Identification with electronic chip, administrative reform... to improve recognition awareness of health sector staff as well as the community about digital transformation.

1.3. Developing digital economy in healthcare

The Department of Health of Thai Nguyen province has deployed online payment and developed e-commerce in the medical sector. Units under the Department of Health pay 100% of public services via banks; increase the installation of card acceptance devices at medical facilities to quickly pay hospital fees, saving medical examination and treatment time.

Up to now, 100% of provincial and district medical facilities have placed POS orders for payment via ATM cards and credit cards; create and post unit accounts for patients to pay via smart banking services, e-wallets (Momo, Moca...), scan QR codes; Develop processes and propagate about the benefits of this payment method to patients and their families; Arrange the reception department to guide and support people in implementation; Design and install a system of signs and notices placed in faculties and rooms to guide the process of non-cash payment of hospital fees. In 2022 the goal of 100% of provincial and district medical facilities making non-cash payment of hospital fees has been completed as set out in Resolution 02/NQ-CP. This has helped connect medical software with banks to quickly pay hospital fees, saving time for medical examination and treatment...

1.4. Developing a digital society in healthcare

To develop a digital society in healthcare, all 100% of medical units and facilities have maintained the deployment and use of operating document management system software; software to serve professional work and use the province's shared software systems effectively, meeting practical requirements.

- Increasing access to medical services through technology:

Thai Nguyen province has deployed the province's platforms and applications such as: C-Thai Nguyen, Thai Nguyen ID, Electronic Health Book, VNeID application to civil servants, public employees, workers, patients and their families in the health sector; Identify and register residence through the VneID application to serve crime prevention, residence management and data enrichment. This increases convenience and flexibility for patients, especially in making appointments, receiving test results, and interacting with doctors.

Public and private hospitals have accelerated the process of moving towards smart hospitals, promoting the provision of medical services on digital platforms. Build sections on the website to publicize services, register remote medical examination and treatment schedules for civils, support remote medical examination and treatment consultation...); 17/17 medical facilities under the Department have registered and deployed a remote medical examination and treatment platform at medical facilities to serve professional training, examination consultation, and treatment consultation.

- Integrating medical information systems:

Implementing Decision 06/QD-TTg dated January 6, 2022 of the Prime Minister on approving the "Project to develop application of population data, electronic identification and authentication for national digital transformation in period 2022 - 2025, vision to 2030", Covid-19 vaccination facilities in the Health sector have coordinated with the Provincial Police to authenticate vaccination data, update vaccination data on the system, equipped digital signatures for 100% health stations in commune, ward and town.

100% of medical facilities with health insurance in the province have implemented searching health insurance information using citizen identification cards with electronic chips. Receiving information about medical examination and treatment with health insurance using citizen identification, up to now, there have been 792,199 CI lookups and 678,740 successful searches (the number of unsuccessful searches was due to unaccumulated health insurance data, the process of authenticating CI to replace health insurance card was error); Number of CI synchronized with valid health insurance cards for medical examination with CI: 1,158,462/1,183,288 health insurance cards (corresponding to a rate of 97.9% of the total number of issued health insurance cards).

No	Targets	Unit	Total	Number of digital transformations	Digital conversion rate
1	Application of commune-level medical software	Commune health station	177	177	100%
2	Electronic health records and electronic health book installation	Health facilities	213	205	96,2%
3	Connecting health insurance data on the health insurance assessment portal	Health facilities	213	213	100%
4	The number of CI is synchronized with the health insurance card for	Health insurance card	1.183.288	1.158.462	97,9%

	medical examination and treatment using CI				
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Table 2. Indicators for assessing social development of healthcare in Thai Nguyen province by 2023

(Source: Department of Health of Thai Nguyen province, 2023)

Electronic health record (EHR) usage rate: measures the proportion of hospitals and medical facilities using electronic health record systems instead of traditional paper medical records. Using EHR enhances information management, reduces errors, and increases interaction between medical departments. By 2023, the number of medical facilities that have applied electronic health records is 205 units, corresponding to 96.2% of the total number of medical facilities.

Regarding the connection of health insurance data on the Health Insurance Assessment Portal: 100% of medical facilities in the province have linked from the unit's software to make health insurance payments and connect people's medical examination and treatment data.

- *Developing medical software at the commune level:*

Management platform for commune, ward and town health stations: 178/178 health stations use software to manage 18 health programs provided by VNPT and Viettel. The management system is promoting positive effects, helping station officials better manage population; drugs, equipment - supplies; healthcare; health care program; personnel; user and reporting system. Especially, it created convenience for management levels, check, view reports directly, ensure accuracy and timely updates...

Thai Nguyen Health Sector has coordinated with the Provincial Police to authenticate vaccination data; Coordinate with the Department of Information and Communications to equip digital signatures for 100% of commune, ward and town medical stations. Up to now, there have been more than 3.3 million injections updated on the system; About 3.3 million vaccinations, equivalent to over 1.2 million people with permanent residence in the province, have signed vaccine passports.

- *National pharmacy and prescription system:*

There have been 1,360 national pharmacy software establishments; has deployed identification codes for all 213 medical facilities and 1,200 identification codes for doctors and physicians to connect electronic prescriptions with the national prescription system. By 2023, there have been 1,448,420 prescriptions linked to the national prescription system.

1.5. Developing technical infrastructure to serve digital transformation in healthcare

Medical facilities have upgrade information technology infrastructure to meet the criteria for building smart hospitals according to Circular 54/2017/TT-BYT. The Department of Health and its affiliated units have synchronously implemented anti-malware measures, protecting 100% of workstations and related terminals; Developing and implementing contingency plans, back up data, and ensure continuous operation of the agency; Be ready to restore normal system operation after encountering network information insecurity incidents; Ensuring stable operation of IPv6; Deploying the installation of virus monitoring and anti-virus software at the Department and its affiliated units; Regularly check and monitor the Department's information system to promptly correct and fix problems when they occur. There are specialized staff in information technology to manage and operate the server system and internet connection of the Department and its affiliated units; Regularly update warnings about computer problems, security holes... and apply according to instructions to fix the above problems.

2. Difficulties and challenges in digital transformation in healthcare in Thai Nguyen province

2.1. Developing digital institutions in healthcare

Documents regulating the implementation of information technology in healthcare are still slow and do not meet reality (remote medical activities have just been implemented, implementation efficiency is still low, there has been no complete instructions on the financial mechanism and relevant regulations on remote medical examination and treatment).

The development of digital institutions in healthcare still faces difficulties due to insufficient financial resources and limited technical ability to use digital tools of civil people and medical teams. This is because information technology investment procedures still have many problems; The investment cost for digital transformation is too large but has not been calculated correctly or fully into the price of medical services; There are no specific instructions on health insurance payments for electronic medical records.

2.2. Developing digital awareness in healthcare

Leaders of some affiliated units are not decisive, confused in carrying out digital transformation tasks and implementing the healthcare digital transformation project. In the province, there are only a few communication

and education programs on digital transformation in healthcare to medical staffs and civil people; Communication forms are not diverse and have not attracted the attention of staff at medical facilities.

Professional human resources in information technology at health facilities are lacking and need to be trained and specialized in information safety and security; There is no remuneration policy, so retaining and attracting high-quality human resources is difficult. There is a shortage of specialized information technology staff at health facilities; Instructions on the cost of hiring information technology services are not clear...

2.3. Developing digital economy in healthcare

The application of non-cash payment and registration of remote medical examination and treatment still faces some difficulties, especially for the elderly, people in difficult circumstances, and ethnic minorities living in mountainous areas. In addition, the internet infrastructure at some medical facilities in these area is limited, affecting the ability to make non-cash payments.

The rate of non-cash payment of hospital fees is not high due to people's habit of using cash and not trusting smart services. Health stations do not have their own accounts, patients coming for examination at commune health stations using health insurance cards so non-cash payment at commune-level medical facilities is not feasible.

2.4. Developing a digital society in healthcare

- Data of national health system's platforms are not synchronized and interconnected with the national population database, leading to scattered databases and the lack of shared and synchronized connections between information systems.

In the process of implementing electronic health records and VNEID applications, there have been still some problems such as a small number of patients not using smartphones, especially elderly patients and patients in remote areas, so medical staff must declare on their behalf. If these cases are entered manually on the VNEID application, it takes a lot of time for medical staff.

- Regarding the updating of health certificate data to the Health Insurance Assessment Portal, facilities are having difficulty with costs to build APIs that automatically push data to the Health Insurance Assessment Portal, most of them are still doing it manually on the Social Insurance website. Correcting error records but already pushed on the gate is difficult when there is no processing instruction. Medical facilities are facing problems with the process of integrating unit digital signatures into documents because the digital signatures are maintained by the archives and can only be used for the purpose of issuing documents and cannot be shared with others medical activities. In addition, the Department of Health has not been authorized by the Ministry of Health and Social Insurance to monitor the interconnected data of affiliated medical examination and treatment units.

- Regarding the national pharmacy and prescription system: up to now, it has not been possible to digitally sign electronic prescriptions to have legal value in the online environment; Pharmacies and dispensaries do not connect and update data to the national pharmacy database system; and people have a habit of using prescriptions received from doctors, and do not trust the digital environment.

2.5. Developing technical infrastructure to serve digital transformation in healthcare

Infrastructure and equipment at some medical facilities in Thai Nguyen, especially in remote areas such as Dinh Hoa district and Vo Nhai district are lacking, inconsistent and do not meet development requirements. The technical infrastructure of server equipment, storage, connection networks and ensuring network information security has not met the requirements of deploying technical solutions to carry out medical digital transformation tasks in Thai province. Although some software has been applied in healthcare management, their use still faces many difficulties and the full potential of information technology has not been exploited.

The medical industry is a target for attacks by hackers because it stores a lot of sensitive patient information, so ensuring information safety and security for medical information systems at hospitals has received attention from health sector. However, there are still limitations compared to the increasing requirements for information security, requiring large costs to invest, upgrade, and synchronize information security systems (while the funding source for investment and development is still limited, especially after more than 2 years of fighting the COVID-19 epidemic). Some medical facilities have not invested adequately in network security systems, leading to a high risk of being attacked. In addition, many old patients and people in rural areas are still skeptical and worried about the security and legitimacy of information provided on medical platforms.

CONCLUSION

Digital transformation is not simply an effort to invest in the application of information technology, but is a comprehensive and profound reform, aiming to maximize the power of the times and technological advances,

thereby improving efficiency, competitiveness and creating the basic foundation for the sustainable development. Based on the results of analyzing the current situation of digital transformation in the health sector in Thai Nguyen province, it has been shown that the Department of Health of Thai Nguyen province as well as its affiliated health units have implemented the content of digital transformation in healthcare quite well includes digital institutions, digital awareness, digital economy and digital society in healthcare. However, the information technology infrastructure in healthcare still has some shortcomings and the issue of ensuring health information security has not been really focused on. This requires the Department of Health of Thai Nguyen province and medical facilities to have synchronous solutions to digitally transform in healthcare quickly and safely. Some solutions proposed are as follows:

- (1) Actively propagate and disseminate to raise awareness and equip basic skills on digital transformation, information technology, and information security for officials, civil servants and workers in the agency, unit.
- (2) Ensure complete and clear digital legal and institutional corridors; Complete the system of legal documents, standards, regulations, and payment norms in the field of health IT.
- (3) Develop medical data integration platform; Connect and share data between specialized medical databases.
- (4) There should be a policy to increase coverage and reduce internet connection costs in remote areas to help people access technology and be ready to use non-cash payment services.
- (5) Develop a plan to ensure information system security for medical units under the Department of Health of Thai Nguyen province.

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