**Cultivating institutions for the national e-prescription system in Vietnam**

**Abstract:**

This research aims to explore the role of institutions in the successful implementation and sustainability of the national e-prescription system in Vietnam. The national e-prescription system was introduced in Vietnam in 2019 as a pilot project in several provinces, and has since been gradually rolled out to the entire country. However, despite its potential benefits, the system has faced several challenges in terms of implementation and adoption by healthcare practitioners. Through a qualitative study using interviews and document analysis, this research aims to understand the factors that have contributed to the successes and challenges of the e-prescription system in Vietnam, and how institutions can be cultivated to support its sustainable growth. Findings from this research will have implications for policymakers and practitioners in the healthcare sector, as well as for other countries considering the adoption of similar e-prescription systems.

Keywords: e-prescription, information infrastructure, medical licensing, antibiotic resistance

Introduction

Antibiotic resistance is a major global health threat, with the World Health Organization (WHO) estimating that around 700,000 people die each year due to drug-resistant infections. Antibiotic resistance occurs when bacteria evolve to become resistant to the drugs that are used to treat infections (Frieri et al., 2017). This can lead to the spread of infections that are more difficult to treat and can result in longer hospital stays, higher healthcare costs, and increased morbidity and mortality (MacGowan & Macnaughton, 2017).

One of the major challenges in the global fight against antibiotic resistance is the availability of antibiotics without a prescription (Yelin & Kishony, 2018). In many countries, antibiotics can be easily obtained from pharmacies and other outlets without the need for a prescription from a healthcare provider (MacGowan & Macnaughton, 2017). This practice, known as "over-the-counter" (OTC) sales, has been identified as a significant contributor to the inappropriate use and misuse of antibiotics, which can lead to the development of antibiotic resistance (Yelin & Kishony, 2018).

To address this issue, many countries have implemented laws and regulations that require the purchase of antibiotics to be restricted to those with a prescription from a healthcare provider (Aldughayfiq & Sampalli, 2021). These "prescription-only" (POM) laws are designed to ensure that antibiotics are only used when they are medically necessary and are prescribed by a qualified healthcare provider who has assessed the patient's needs and determined the appropriate course of treatment (Lakshmi, 2008).

E-prescribing systems can play a crucial role in enforcing POM laws by providing a secure and efficient means of issuing and transmitting prescriptions for antibiotics (Aldughayfiq & Sampalli, 2021). Traditional paper-based prescription systems can be prone to errors and fraud, and can be time-consuming and inconvenient for both healthcare providers and patients (Farre et al., 2016). E-prescribing systems, on the other hand, can provide a more efficient and secure means of issuing and transmitting prescriptions, as well as enabling the tracking and monitoring of prescribing patterns (Wilkinson, 2019).

By using e-prescribing systems, healthcare providers can easily and securely issue prescriptions for antibiotics, which can then be transmitted electronically to the pharmacy or other point of sale (Hand et al., 2017). This can help to ensure that only those with a valid prescription from a healthcare provider are able to obtain antibiotics, reducing the risk of OTC sales and misuse (Lee-A-Ping et al., 2019).

In addition, e-prescribing systems can enable the tracking and monitoring of prescribing patterns, allowing for the identification of any potential issues or concerns related to antibiotic use (Polyzos et al., 2016). This can help to ensure that POM laws are being effectively enforced and that antibiotics are being used appropriately.

Despite all the benefits it might bring, building such a national e-prescription system is extremely challenging task for a number of reasons (Lanham et al., 2016). First, building a national e-prescription system requires the integration of multiple different technologies and systems, including electronic health records, pharmacy management systems, and payment systems. Ensuring that these systems are compatible and work seamlessly together can be a major challenge (Lanham et al., 2016). Second, building a national e-prescription system often requires the cooperation and coordination of multiple different organizations, including hospitals, pharmacies, and insurance providers (Aldughayfiq & Sampalli, 2021). Ensuring that all of these organizations are able to work together effectively can be a major challenge. There are also other challenges related to culture and finance etc. A national e-prescription system can be expensive to build, and may require significant investment from both the public and private sectors. Ensuring that the necessary resources are available to support the system can be a major challenge (Aldughayfiq & Sampalli, 2021).

To address these challenges, this paper examines an effort of building a national e-prescription in a Southeast Asia country. Using data collected through interviews, document archive analysis, and participant observations, we seek answers for the question:

*“What are the appropriate approaches to build a national e-prescription system in a developing country?”*

Drawing on institutional theory and information infrastructure perspective, especially the concept of cultivating which refers to introduction of interactive and incremental changes to the existing installed base, we argue that the need of establishing proper institutions to support the success of such a system.

The remainder of the paper is organized as follows. The review of related research is provided in section 2 followed by section 3 in which methods and approaches used in this study are presented. In section 4, the case of the epidemic reporting systems in Vietnam is introduced, while analysis and discussion are provided in section 5. This paper is concluded in section 6.

Related research

Information infrastructure and cultivation

Information infrastructure refers to the large-scale and complex systems that enable the sharing and processing of information, such as networks and databases (Sommerville et al., 2012). These systems are characterized by five properties: shared, evolving, heterogeneous, open, and standardized (Hanseth, 2002). The process of building and maintaining information infrastructure is often referred to as infrastructuring works (Aanestad et al., 2014).

One approach to understanding the process of II evolution is the concept of cultivating, which refers to the introduction of interactive and incremental changes to an existing installed base (Henfridsson & Bygstad, 2013). This process involves balancing tensions between stability and flexibility, control and autonomy, and new and old elements of the infrastructure (Rodon & Hanseth, 2015).

A number of studies have examined the role of institutions in shaping the evolution and adoption of information infrastructure. For example, Ciborra (2000) argued that the success of information infrastructure projects depends on the alignment of organizational and technical factors, as well as the presence of supportive institutions. Grisot et al. (2014) identified favorable conditions for the growth of information infrastructure, including the alignment of stakeholders' interests and the availability of resources.

Overall, the literature suggests that the process of building and maintaining information infrastructure is complex and involves a range of social, technical, and organizational factors. Cultivating information infrastructure requires the careful management of tensions and the alignment of institutions to support its evolution and adoption.

Institutional theory

Institutional theory is a perspective in the social sciences that focuses on the role of formal and informal rules, norms, and values in shaping human behavior and shaping the functioning of organizations and societies.

One key concept within institution theory is the idea of institutionalization, which refers to the process by which rules, norms, and values become established and accepted within a society or organization. Research has examined the factors that contribute to the institutionalization of rules and norms, such as the degree of uncertainty, the level of commitment of actors, and the type of institutions involved (DiMaggio & Powell, 1983; Scott, 1995).

Another important concept within institution theory is the idea of institutional logics, which refer to the underlying values and beliefs that shape the behavior of organizations and individuals (Thornton & Ocasio, 2008). Research has examined the role of institutional logics in shaping organizational behavior and decision-making, as well as the ways in which different institutional logics may conflict or be reconciled (Thornton & Ocasio, 2008).

Institutional theory has also been applied to the study of organizational change, with research examining the role of institutions in shaping the direction and pace of change. This research has identified a range of factors, including the strength and stability of institutions, the presence of institutional entrepreneurs, and the level of institutionalization of new practices, as important considerations in the process of organizational change (Pache & Santos, 2010).

A number of studies have applied institutional theory to the field of information systems, exploring how institutions shape the adoption and use of technology (Orlikowski & Scott, 2008; Scott & Orlikowski, 2014). For example, Orlikowski and Scott (2008) examined the role of institutions in shaping the adoption and diffusion of enterprise resource planning systems. They found that the presence of supportive institutions, such as clear rules and regulations, was crucial for the successful implementation of these systems.

Other studies have applied institutional theory to understanding the evolution of information infrastructure (Henfridsson & Bygstad, 2013). These studies have argued that the evolution of information infrastructure is shaped by the interaction of technical and social factors, as well as the presence of supportive institutions.

Alzadjali and Elbanna (2020) explores the role of smart institutional intervention in the adoption of digital infrastructure, specifically government cloud computing in Oman. The study provides insights into the challenges faced by the government in implementing cloud computing and the strategies and interventions that have been implemented to overcome these challenges.

Hinings et al. (2018) examines digital innovation and transformation from an institutional perspective. The authors provide insights into the role of institutions in shaping digital innovation and the impact of digital transformation on organizations and society as a whole.

Overall, the literature suggests that institution theory provides a useful perspective for understanding the role of institutions in shaping the adoption and evolution of information systems and information infrastructure.

E-prescription

The search for effective ways to implement successful electronic prescribing systems has been a common topic in academic research. Aldughayfiq and Sampalli (2021) compares e-prescription systems' architecture and digital security in eight countries. The study provides insights into the current state of digital health in physicians' and pharmacists' offices and assesses the strengths and weaknesses of e-prescription systems in different countries.

Farre et al. (2016) examine the perceptions and experiences of healthcare professionals regarding the implementation, management, use, and optimization of electronic prescribing systems in hospital settings. The authors conduct a systematic review of existing qualitative research to gain a deeper understanding of the attitudes and experiences of healthcare professionals in relation to electronic prescribing systems in hospital settings.

As it is clearly shows e-prescription is a widely studied topic in academia due to its significance in the healthcare industry. Previous research has tended to focus either on the technical aspects or the social aspects of e-prescription systems. However, it has become increasingly clear that the successful building of digital infrastructures requires a combined technical and social approach. Therefore, institutional theory provides a useful framework for examining this phenomenon, and has the potential to reveal deeper insights into the topic.

The proposed theoretical concept: Cultivating institutions

According to institutional theory, institutions are key factors that play a crucial role in promoting organizational change and are critical to the success of creating information infrastructures. However, the challenge lies in identifying the appropriate institutions to get involved, as the process of constructing large and complex information infrastructures is often difficult and time-consuming. To overcome this challenge, the authors propose a novel approach they call "cultivating institutions." This approach involves a multi-faceted, interactive, and gradual process that involves various levels of social and technical factors and seeks to reinforce each necessary institution involved in creating successful information infrastructures.

Research methods

The research method and approach for this study is qualitative in nature. Qualitative research is a type of research that involves collecting, interpreting, and analyzing data in the form of words, images, or sounds, rather than numbers (Creswell & Poth, 2016). It is often used to explore and understand people's experiences, perspectives, and meanings, and is well-suited to studies that aim to generate insights and understanding rather than to test hypotheses or establish cause and effect relationships (Creswell & Poth, 2016).

The choice of qualitative research as the method and approach for this study was guided by the research questions and objectives of the study, which focused on understanding the challenges and approaches of building national e-prescriptions. Qualitative research allowed for an in-depth exploration of these issues, and provided a rich and nuanced understanding of the subject matter.

To collect data for this study, a range of qualitative data collection methods were used, including semi-structured interviews, focus groups, and field observations. These methods were chosen because they allowed for a flexible and interactive approach to data collection, and provided an opportunity for the participants to share their experiences and perspectives in their own words (Creswell & Poth, 2016).

The data collected from these methods was analyzed using a qualitative data analysis software, which allowed for the organization and coding of the data in a systematic and transparent way. The analysis of the data involved the identification of themes and patterns in the data, and the interpretation of these in the context of the research questions and objectives.

The case

In Vietnam, the rate of antimicrobial resistance (AMR) is high, particularly among pathogens isolated from clinical specimens. In 2016, health expenditure made up 5.7% of Vietnam's GDP, with antimicrobials accounting for one-third of the total spend on medications in public hospitals. The country has one of the highest rates of AMR in Asia and a study in rural Vietnam found that multidrug resistance among S. pneumoniae in preschool children increased from 31% to 80% over a 15-year period (1999-2014).

Overuse of antimicrobial drugs in both the animal and human sectors, as well as in hospitals and the community, is a major contributor to the rise in AMR. Vietnam has a higher rate of prescribing antimicrobial drugs than many European Union countries, with 261.7 mg/kg and 247.3 mg/kg of antimicrobial use in humans and animals, respectively, compared to 122.0 mg/kg and 151.5 mg/kg in the EU. A review of antibiotic consumption in rural Vietnam found high consumption of "Watch group" antibiotics, particularly in children, which were frequently obtained from private pharmacies.

In 2013, Vietnam adopted a national action plan to address antimicrobial resistance as the first country in the Western Pacific Region of the World Health Organization (WHO). A key component of the plan is the establishment of a national surveillance system for antimicrobial resistance and improving laboratory capacity to monitor and detect resistant bacteria. This is expected to enhance Vietnam's ability to respond to antimicrobial resistance and improve patient safety in Vietnam, the region, and globally. There are various factors that contribute to the spread of antimicrobial resistance in Vietnam, including a lack of resources and trained personnel in laboratories to accurately detect some types of resistance, inadequate infection control in overcrowded and understaffed hospitals, and inappropriate prescribing of antibiotics. Additionally, surveillance for antimicrobial resistance is not consistently conducted or coordinated through a central government agency, and data from testing in major hospitals is often not analyzed, shared, or used for action at the hospital or national level.

To pursue that plan, The Vietnam Administration for Medical Services (VAMS), with the assistance of the Centers for Disease Control (CDC), is implementing a national surveillance system to standardize the collection of antibiotic resistance data across healthcare facilities in the country. This will enable the Ministry of Health (MoH) to better understand the extent of antibiotic resistance in Vietnam and track any changes or trends that could have global impacts.

Other measure such as implementing a nation-wide e-prescription system has also been selected to combat with that problem. One way in which a national e-prescription system can help resolve the issue of antibiotic resistance is by promoting more appropriate prescribing practices. E-prescribing systems can help ensure that prescriptions are based on accurate diagnoses and that appropriate antibiotics are prescribed for the specific type of infection being treated. They can also help reduce the number of unnecessary prescriptions by providing real-time access to patient medical histories and allowing for electronic communication between healthcare providers. Additionally, e-prescribing systems can help monitor and track the use of antibiotics, allowing for the identification of patterns of overuse and the development of targeted interventions to address this issue. By promoting better prescribing practices and reducing unnecessary antibiotic use, a national e-prescription system can help reduce the prevalence of antibiotic resistance in Vietnam.

The system would have a number of components. A central repository will help with capturing all prescriptions sent from doctors, hospitals, and medical facilities. It also exposes a set of API for authentication and authorization, and to allow other systems to send prescriptions via standard REST API protocol. As most of hospitals and doctors have already used some forms of e-prescriptions provided by hospital management systems, prescriptions data would be extract from those systems and wrapped in a message and sent to the repository API.

In 2019, a company, referred to as ACom, was chosen to build and transfer ownership of the portal to the Vietnam Administration for Medical Services (VAMS). This approach avoided any issues related to public purchase procedures, such as long and tedious tender processes. In order to receive the contract, ACom had to agree to transfer the system to VAMS upon completion. VAMS had to prepare its human resources to take over the system. Although there were no direct financial benefits associated with the build and transfer, ACom would sell services that connect existing local e-prescription systems to the portal. There was also an agreement that these connecting services were not exclusive, and ACom had to allow other third parties to enter the market by offering similar solutions.

In the same year, the portal was completed and trialed in 2 provinces which are Ha Tinh and Hung Yen. At the end of the year, all the prescriptions in public hospitals of these two provinces were successfully transferred to the portal.

Following that, in April 2022, MoH issued a guideline (Decision 808/QĐ-BYT) on how to operate this portal. The guideline outlines protocols that each stakeholders must adhere to in order to enable successful connection.

According to the guideline, the responsibility for managing and operating the national information system for drug prescription and prescription drug sales falls on VAMS. The provincial departments of health must contact VAMS to obtain administrative accounts for the system. This system can be accessed through the website www.donthuocquocgia.vn and includes instructions for registering and using the system. Medical practice facilities and practitioners under the management of the Department of Health must register their identification information on the system through the website or by submitting a list to the VAMS. Once the documents are approved, an identifier will be assigned to each profile by the system. The Department of Health and branch health organizations are responsible for distributing these identifiers to practitioners and medical facilities.

The guideline mandates The Drug Administration of Vietnam (VDA) requires the drug supplier management software provider to modify the software to meet the request of receiving prescriptions from the portal for managing drug prescriptions and selling drugs according to prescriptions. VDA shall coordinate with the VAMS to create a connection account for suppliers of drug supplier management software (Point of Sales). The report of prescriptions sold will be attached to this account to verify which software the prescription is sold by, and which facility it is sold by. Simultaneously, the drug supply management software sends a report on the prescriptions sold to the portal.

The guidelines also request doctors to register information to be granted an identification code on the system at the website: www.donthuocquocgia.vn or send information to the unit you are working for collective registration. After the medical facility management software completes editing, prescribes drugs as previously done, and the IT system automatically sends a prescription report. Citizens can search for their own prescriptions through the prescription code on the system at the website: www.donthuocquocgia.vn

In May 2022, MoH has decided on pilot implementation of the portal in 9 provinces and cities including Phu Tho, Quang Ninh, Hai Phong, Nghe An, Can Tho, and Ha Tinh. , Lai Chau, Cao Bang, Ninh Thuan and Hanoi Medical University Hospital. At the end of 2022, there have been nearly 3,600 doctors and 379 medical facilities participating in this system. The prescription meter has updated more than 2,086 million electronic prescriptions sent to the system after 6 months of implementation.

Findings

We first discuss the challenges involved in building and implementing a national e-prescription system. We then examine the approaches taken to establish the necessary institutions for a successful system. Finally, we argue why cultivating institution is powerful theoretical lens to examine the process of building large scale and complex information infrastructures.

Challenges

Public procurement challenge

In Vietnam, most health facilities are owned by the government, which means that any spending on hardware, software, or services must go through a complex and time-consuming tender process. This process requires a large number of documents and can be burdensome regardless of the size or value of the project. The tender process is also susceptible to bid collusion, where joint companies submit separate bids with different prices, and one company is chosen to win the bid. There have also been instances where the project owner colludes with companies to create criteria that only those companies can meet, effectively excluding other competitors. The high level of politics involved in the tender process often leads to delays, over-budget projects, and low-quality outcomes.

The healthcare sector in Vietnam faces a number of challenges in public procurement beyond the complex tender process. Some projects are funded by international donors through donations or loans, and the ownership of the final projects is not always clear, leading to difficulties with handover when the projects are completed. Additionally, free donations of software may not provide sufficient motivation for staff at the Ministry of Health (MoH) who are already overwhelmed with their daily tasks.

There have also been instances where large state-owned companies have approached the MoH for collaboration, and preference is often given to these companies over small and medium-sized private companies (SMEs), which are thought to be a vital part of the innovation ecosystem. This can exclude SMEs from the bidding process and limit their opportunities for participation. Sahay et al. (2009) discuss the issue of asymmetric integration when small actor with greater potential of innovation struggled to integrate with big companies in building a software for the public healthcare sector in India.

Interoperability challenge

Connecting various diverse components, known as integration, has long been a goal of information systems research. Researchers have consistently sought ways to achieve seamless integration (Sahay et al., 2009). However, to make integration possible, the issue of interoperability must be addressed. Interoperability refers to the ability of different components to work together and exchange data. Without interoperability, integration cannot be achieved.

The interoperability problem arises when different information systems are unable to communicate and exchange information effectively. This can be due to technical differences, such as the use of different technologies, protocols, and data formats. It can also be caused by semantic differences, where different systems use different terms and definitions for the same concepts. Organizational differences, such as different policies, procedures, and governance practices, can also hinder interoperability. Security concerns, such as the need to protect sensitive data, can also be a factor. To address these issues, organizations may need to implement interoperability standards and frameworks, and work closely with one another to ensure that the systems can communicate effectively.

In order to make the portal works, there must be a set of underlying infrastructures ready. The first one is the master list of health facilities with unique identity. The second one is the master list of licensed doctors who are allowed to give prescriptions. Fortunately, these two lists are made available previously as since 2015 MoH had a separate project to build a system for medical licensing.

A master drug list is a standardized list that must be prepared for the exchange of prescriptions. The pharmaceutical industry is vast and complex, with a wide variety of naming conventions for drugs. This can make it challenging to create a comprehensive master drug list for prescription exchange. There are two types of drug names: generic and brand. When prescribing drugs, a prescription may include various drugs with different doses, packaging, administration methods, quantities, and duration of use. To effectively exchange data, local electronic prescription software must map its local drug list to a master drug list. However, this process can be time-consuming and prone to errors, as it must be done manually and requires significant effort.

The scaling challenge

The first challenge that faces the development of the national e-prescription system is the scale. There are nearly 50,000 health care facilities in the country. 95% of publicly owned facilities have a prescription management software, but they are not uniform or interconnected. 90% of private facilities do not have a prescription management software. 70% of pharmacies have a prescription management software, but do not sell drugs based on prescriptions.

Sahay et al. (2013) argues that scaling is not a merely technical issue with which a technology can be simply copied from one place to the others. However, it would require the scaling in human resources, planning, design, physical infrastructure respectively.

One key challenge here is the need to design and build an information infrastructure that is able to support the exchange of prescription information across a diverse and dispersed network of healthcare providers. The myriad of health facilities needs to be connected to the portal entails a huge workload to complete. As each health facility uses a different software for their local prescription, it poses another paramount challenge to overcome. Even though the portal has been standardized to receive data from health facilities, it would require thousands of connectors to connect existing e-prescription systems to the portal.

Approaches to combat the challenges: Cultivating institutions

We now discuss how different stakeholders involved in the system combat those challenges and move a big step toward a sustainable national e-prescription system.

Institutionalizing Public-Private Partnerships for Public Investment

Unlike other projects at MoH, the project to build and implement the national e-prescription system did not follow the common public procurement pathway. Instead of proposing a project and submitting for approval, then waiting for budget allocated, giving the project to a private company to build and transfer is novel. This is like the public private partnership collaboration. Public-private partnerships (PPPs) involve the collaboration between public and private sector organizations to deliver healthcare services and infrastructure, with the goal of improving access and quality of care while also achieving financial sustainability.

There have been a number of studies on PPPs in healthcare in the literature. One study found that PPPs can be an effective way to finance and deliver healthcare services, especially in low- and middle-income countries where the public sector may have limited resources. However, the authors also caution that PPPs can pose risks, such as the potential for privatization of essential services and the transfer of financial and operational risks to the private sector. Another study examined the use of PPPs in the construction and operation of hospitals in developing countries. The authors found that PPPs can be a viable option for healthcare infrastructure development, but they recommend careful planning and oversight to ensure that the partnerships align with the broader goals of the healthcare system. A study on PPPs in the healthcare sector in Sub-Saharan Africa found that PPPs can be a useful tool for addressing the challenges of inadequate infrastructure and limited funding, but they also identified a number of issues that need to be addressed, including the need for strong governance and regulatory frameworks, the potential for inequities in access to care, and the need for robust monitoring and evaluation.

In this study, we argue that in addition to the financial motivation that is commonly discussed in the literature, public-private partnerships (PPPs) in digital platform projects are critical for innovation because the companies involved have extensive experience in the field. The private sector is particularly noteworthy for its innovative capabilities due to its small size, agility, and young, dedicated team members. The selected company is typically one that performs better than its peers and is chosen accordingly.

Institutionalizing novel protocols for interoperability

Decision 808/QĐ-BYT, enacted by the Ministry of Health (MoH), has been a key institution in facilitating smooth connectivity and interoperability between local electronic prescription systems and the portal. It establishes a clear path for various stakeholders to gain buy-in and participate in the network. According to Actor Network Theory (ANT), a network is sustainable when all participants can find a way to translate their interests and play specific roles (Law & Hassard, 1999). This decision has ensured that the interests of existing and incoming actors are protected, and has also opened up new opportunities for new players such as software vendors to provide connectors for data interchange between hospitals and the central portal.

Drugstores are also important players in this network. In order to participate, they must upgrade their drug management software to include a connector with the portal. Data will be shared bidirectionally between the drug management software and the central portal. When customers purchase drugs, they can present their ID and the drugstore can look up their prescription to ensure that only prescribed drugs can be purchased. Once the bill is issued, customers cannot purchase that prescription at another drugstore. The selling invoice must also be sent back to the portal to ensure that there is only one purchase per prescription.

This institution, i.e. guideline for integration, is really novel in a number of ways. First, it is the first time a modern and standardized REST API protocols is introduced in a governmental projects. A REST API (Representational State Transfer Application Programming Interface) is a type of web service that allows for the exchange of data between systems over the web. One of the main benefits of using a REST API is that it provides a simple, standardized method for communication between different systems. This can greatly simplify the integration process between different software applications and platforms. In addition, REST APIs are flexible and can support a wide range of data formats, including JSON and XML. This makes them well-suited for use in modern, web-based applications.

Overall, REST APIs provide a reliable and efficient way to exchange data and facilitate communication between different systems. Secondly, it utilizes open standards and allows other stakeholders to participate, rather than excluding them through the use of proprietary software components. Third, to ensure interoperability, the master facility list and doctor list are reused from the existing medical licensing system (Nguyen & Braa, 2016; Nguyen et al., 2015; Nguyen et al., 2017). This innovative approach follows the II design principles of building upon the existing installed base rather than starting from scratch (Hanseth & Lyytinen, 2010). We argue that the national e-prescription system may not be widely adopted if it were to reinvent the wheel by introducing new lists for facilities and doctors. Technically and legally, it is impractical to achieve interoperability without these two lists being available.

Institutionalizing a longitudinal and ever-evolving rollout for scaling challenge

As the process of rolling out the national e-prescription system would take long time to reach a closure, VAMS executive team has made a long-term plan to achieve full coverage for the system. In every decision made by VAMS, there are clear milestones for each phases. For example, in the first phase the system was only tested in 2 small provinces. This help reduce all the complexities that may occur in big cities. After the initial success in the first two provinces, the system was rolled out to other 9 provinces. This would allow testing the system in a larger scale with more diverse user-cases and situated problems. That phase out approach permits the development team improve the central portal and its API. Health facilities could also have some break to gradually upgrade their hospital management software to be compatible with the central portal.

The reality is that building a connector to integrate the local e-prescription system with the portal would be a significant undertaking. In Vietnam, a large hospital could receive up to 4000 prescriptions for outpatient visits, and a 2000-bed hospital would require a similar number of prescriptions for inpatients. Often, hospitals have separate systems for outpatients and inpatients, which would exponentially increase the challenge they may face when integrating. Implementing the integration of these systems would require a significant amount of work.

At the national level, selecting a software vendor to provide the e-prescription solution would be done through a number of options such as tender, Build and Transfer (BT), Build Operate Transfer (BOT), or PPP. However, at public health facilities, tender procedures may be required for public procurement. Once awards are given to the winning vendor, they will need time to build and test the connector. With over 50,000 health facilities in Vietnam, this process will take a significant amount of time.

One important group of stakeholders in this system is drugstores, as they will be responsible for ensuring that prescription drugs are dispensed in accordance with the law and that the "no prescription, no drug" policy is followed for certain medications. Unlike health facilities, which often have relatively well-equipped computers, networks, and financial resources, many drugstores in Vietnam are small in size and may have limited capacity. The Vietnam Antimicrobial Resistance Surveillance System (VAMS) envisions a long-term and ongoing process to achieve its final goal of controlling drug and antibiotic resistance.

Discussion

The process of building a national e-prescription system in Vietnam has been a complex and ongoing process. Examining the process through the lens of cultivating institutions, which refers to the development and maintenance of relationships and trust between different organizations, can provide insight into the challenges and approaches taken to establish the necessary institutions for a successful system.

We now unpack the concept that we proposed earlier to capture all the dynamics of II evolution. We shall discuss it by analyzing 3 facets: leveraging existing institutions, innovating institutions, and stepwise and longitudinal institutionalization.

Leveraging existing institutions

Researchers have agreed that leveraging existing installed base is critical in II design and building (Braa et al., 2007; Grisot et al., 2014; Hanseth, 2010; Hanseth & Lyytinen, 2010; Henningsson & Hanseth, 2011). Cultivating installed base involves building upon the existing infrastructure, resources, and relationships that are already in place. By using the existing installed base, organizations can take advantage of the knowledge, skills, and capabilities that have been developed over time, and avoid the need to start from scratch. This can help to reduce costs, minimize disruptions, and accelerate the implementation process. Leveraging existing institutions can also help to build trust and establish relationships between different organizations, which is critical to the success of the e-prescription system. This approach can be particularly useful in developing countries, where the institutional infrastructure may be less developed and there may be a need to leverage existing resources and relationships.

In this study, we deliberately seek out institutional installed bases, which are existing formal and informal rules, norms, practices, beliefs, cultures, etc. that are relevant to the evolution of the e-prescription II. We have identified existing institutions such as the authorized master list of health facilities and licensed doctors, which have been built upon to enable interoperability and standardization (Nguyen et al., 2017). The development team of the national e-prescription system has leveraged the existing installed base and developed it further, rather than building it from scratch.

We have also identified another institution, the mapping between global and local lists, which has been a practice in VAMS and has shown positive outcomes. This mapping has been used to build previous standardized lists, such as the mapping between medical services for treatment and insurance (Nguyen & Braa, 2016).

Building upon an installed base, particularly one that includes elements related to institutions, is an important aspect of developing and maintaining a successful information infrastructure. It allows organizations to leverage existing resources and relationships, support future growth and development, and create a foundation for trust and cooperation.

Innovating institutions:

Innovating institutions refers to the process of introducing new policies, practices, technologies, or other elements that can support the development and adoption of information systems (Orlikowski & Scott, 2008). Innovating institutions can involve a wide range of activities, such as introducing new regulations or standards (Scott, 1995), establishing partnerships or collaborations (Zucker, 1987), developing new technologies or platforms, or creating new organizational structures or processes (Scott, 1995),. The goal of innovating institutions is to create a supportive environment for the development and adoption of information systems, and to facilitate the exchange of information and knowledge between different organizations (Orlikowski & Scott, 2008). Innovating institutions can be particularly important in the context of information infrastructure, as they can help to facilitate interoperability, standardization, and collaboration, which are critical to the success of these systems (Zucker, 1987).

According to our empirical data in this case, we conceptualize innovating institutions as a process of introducing new approaches to address chronic problems in II development related project. These institutions go beyond traditional forms of institutions, including not only formal legal documents, norm, and practice but also novel ways of doing things. For example, the use of open standards such as REST API for connectivity and interoperability can be considered a new approach. Mapping local and national lists of drugs or lists of licensed doctors can also be considered an innovating institution. Similarly, selecting PPP as a form of progressing the project instead of using the long and tedious tender process could also be considered an innovating institution.

There is also a conceptual link between our findings and the concept of frugal innovation (Sahay & Walsham, 2014). Frugal innovation is a term that refers to the process of developing products, services, or systems that are simple, affordable, and accessible to a wide range of users, particularly in developing countries (Bhatti, 2012). Frugal innovation is often focused on addressing the needs of underserved or marginalized communities, and on finding solutions to problems that are specific to these communities. This approach to innovation is characterized by a focus on resourcefulness and efficiency, and on using limited resources in creative ways to achieve maximum impact. Frugal innovation can involve a wide range of activities, including designing products that can be easily adapted to local conditions, using alternative materials or technologies, and finding ways to reduce costs and increase affordability. According to Sahay and Walsham (2014), frugal innovation has the potential to not only improve the lives of people in developing countries, but also to drive economic growth and development. In our study, reusing existing installed base and giving contracts to local software vendors are good example of frugal innovation.

Stepwise and longitudinal institutionalization

Cultivating installed bases in information infrastructures (II) often involves introducing incremental, stepwise changes (Jensen, 2013). We can see this approach in the process of institutionalizing the "prescription-only" drug policy (WHO, 2017) in Vietnam. Under this policy, drugs that are classified as prescription-only must be dispensed only with a valid prescription from a licensed healthcare provider. This policy is intended to help ensure that drugs are used appropriately and safely, and to prevent the misuse or abuse of prescription drugs (NHS, 2019). In some countries, prescription-only drugs may be further classified into different categories based on their potential for abuse or dependence, with stricter controls placed on the distribution and use of drugs in higher categories (FDA, 2020). The specific requirements for prescribing and dispensing prescription-only drugs may vary depending on the country or jurisdiction.

In Vietnam, the policy was introduced in a stepwise manner through a piecemeal institutionalization process. It started with the selection of a company to build a working prototype, followed by a pilot phase in two provinces. Only after the proposed connectivity protocols were tested and proven to work did the Vietnam Administration of Medical Services (VAMS) suggest that the Ministry of Health (MoH) formalize and standardize the connection by issuing an official guideline. This stepwise approach is important for achieving the ultimate goal of a working system, as it allows institutions to be put in place gradually.

There is similar discussion on the literature about this stepwise innovation. Incremental innovation refers to the process of making small, incremental changes to existing products, processes, or systems over time (Chesbrough, 2006). This approach is often contrasted with disruptive or radical innovation, which involves more significant or revolutionary changes (Christensen & Raynor, 2003). Incremental innovation and development can be seen as a more gradual and incremental approach to change, and is often characterized by a focus on continuous improvement and the optimization of existing systems (Lerner & Tirole, 2002).

There are a number of benefits to adopting an incremental approach to innovation and development. One advantage is that incremental changes can be implemented more quickly and at lower cost than more radical changes (Chesbrough, 2003). Incremental changes also tend to be more predictable and less risky, as they build on existing systems and technologies (Lerner & Tirole, 2002). This can make it easier for organizations to plan for and manage the changes, and to allocate resources more effectively (Chesbrough, 2003).

Despite these advantages, there are also limitations to incremental innovation and development. One potential drawback is that it may be less effective at addressing significant problems or opportunities, as it tends to focus on optimizing existing systems rather than disrupting them (Christensen & Raynor, 2013). Incremental innovation may also be less effective at generating new sources of value or creating new markets, as it tends to focus on optimizing existing products and processes rather than developing entirely new ones (Chesbrough, 2003).

Our contribution to the existing literature on innovation is the argument for the role of incremental innovation in institutionalization. This approach emphasizes the need for constantly seeking out novel methods to improve the status quo through small, incremental steps. This approach allows for adequate learning and the development of the capacity to cope with the challenges of large-scale and complex information infrastructure evolution.

Conclusion

In recent years, there has been a growing recognition of the potential benefits of implementing a national e-prescription system. By providing a centralized platform for the electronic exchange of prescription information, such a system has the potential to improve the safety, quality, and efficiency of healthcare delivery, and most importantly tackle the problem of antibiotic resistance. It can also reduce the risk of errors and adverse drug events, and improve the tracking and monitoring of medications. At the same time, however, the development and deployment of a national e-prescription system also poses a number of challenges, both technical and organizational. These challenges include issues related to public procurement, interoperability, data integration and standardization, and the adoption and use of the system by healthcare providers and patients. Addressing these challenges will be critical to the success of the e-prescription system and the realization of its potential benefits. In this paper, we have discussed some insights on the approaches to tackle the challenges involved in implementing a national e-prescription system. We theorize these approaches as cultivating institutions, which involves leveraging the existing installed base, enabling innovative institutions, and envisioning a long-term and incremental process of institutionalization. We believe that the concept of cultivating institutions could provide a useful theoretical framework for examining similar phenomena in both developed and developing countries.

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