Developing fully functional e-healthcare information systems: a four-stage framework

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Abstract: National governments of most of the countries have started to create the environment and infrastructure for promoting healthcare delivery systems through an electronic mode to their citizens. However, reports the experiences with e-health as chaotic and unmanageable. The purpose of this research is to enrich the comprehensive inter-organisational systems that are currently available for helping e-health development. A four-stage framework was proposed and three main e-public health information system cases in Taiwan help to ground and explain this framework. These stages outline the multiperspective transformation within traditional healthcare structures and functions as they make transitions to e-health through each stage, barriers and challenges for each stage accompany these descriptions.

Keywords: e-health; e-government; infrastructure; Inter-Organisational Systems (IOSs).

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1 Introduction

As Information Technology (IT) becomes easy and available to all, it is also changed in the speed and efficiency of the connection among organisations. National governments of most of the countries have started using substantial resources to create an environment and infrastructure for promoting healthcare services delivery systems electronically with their citizens, providers and bringing about efficiency and cost savings. Whereas the technological revolution is a radical change that in turn is ushering the e-health we are witnessing now. E-health can be convinced as a paradigm shift away from traditional approach to newly healthcare services delivery (Lorence et al., 2005; Tan, 2005). The core value propositions are necessary for the new business model to invite more participants. For those reasons, to increase user satisfaction, quality of life, safety, effective healthcare services are the responsibility of a government. Moreover, as discussed by Yasnoff et al. (2001), the domain of public healthcare should be conceived as "from a wide variety of sources regarding the health status of every community, to be collected, analysed and disseminated". The technologies for public health preparedness and surveillance are also critical and the potential for a critical mass of transactions are predictable.

To build national e-infrastructure to support the development of the e-health and improve governing process not only beneficial for healthcare services delivery but to accommodate future business models. As the e-health can be viewed as an integrated, multidisciplinary field, the information technologies around individuals, organisations and inter-organisations encompass comprehensive and complicated, the goals in different stakeholders involved will conflict sometimes and the impact of transformation within traditional healthcare structures should be posited. Meanwhile, the information infrastructure generally delivers a more widespread change than other technologies (Carr, 2003). When the components founded on the projects such as National Health Information Infrastructure (NHII), intermediate and compromise problems among those

issues will be more serious. To integrate different ideas, e-government is becoming a powerful tool of transformation that has become embedded in the culture as well as the agenda of the public sector (Torres et al., 2005). This study will focuses on where these two new fields, e-health and e-government, actually interact and how this integration can efficiently be implemented.

Despite recent numerous initiatives at different levels of academic and practitioners' conferences on e-health, the debate among the stakeholders and a number of challenges to public administrators still exists everywhere. The impact of e-health is not only technical but also social and economical (Palanisamy, 2004). As the e-health is a radical IT-based change across organisations, the structure of healthcare services delivery will also change. To outline the multiperspective transformation within structures and functions as they make transitions to e-health and find the e-health becomes blended with the traditional structure, a framework that includes four stages Inter-Organisational Systems (IOSs) for development and management of such projects were proposed. It will be a better solution to manage and promote the e-health projects and avoid mistakes as the characteristics of inter-organisation interdependency in inter-firm relationships is so complicated. The framework is then applied to the case of project in Taiwan, to clearly identify the key issues and basic elements of the e-health and better understand the effect of IOSs on the organisations of healthcare industry. This useful reference model not only could help public administrators to manage the e-health projects and promote the patient empowerment, but also improve the IOSs theory by observing and discussing the interaction in implementing the framework.

2 An overview of e-healthcare information systems

2.1 Vision in e-healthcare information systems

The development of healthcare information systems have already gone through a long period. The information technologies' innovation and applications are closely bound up. There are three main phases in the development: automate, informate and wired and wireless communications. The government and providers are benefited very much through e-healthcare information systems including those information technologies and other e-technologies. In fact, in the context of the e-business revolution, e-health is seen as a paradigm shift from a physician-centred care information system to a customer-driven care system (Tan, 2005). As an integrated, multidisciplinary field, enabled by e-technologies and diffused not only among individuals but also among organisations, transcending geography, demography, time and culture, e-health already open new windows for caregivers, patients, vendors, governments and third-party payers. However, only function appropriately within the context of multisystem interconnect model and appropriate e-networking infrastructures could enable and drive the e-health paradigm shift.

2.2 Type of e-healthcare information systems

E-health includes e-commence information exchange and transactional activities. To build a health data infrastructure that can deliver both public and private

goods, a taxonomy of e-business models is required (Parente, 2000). Three important classes are categorised based on the following groups for the e-healthcare services delivery.

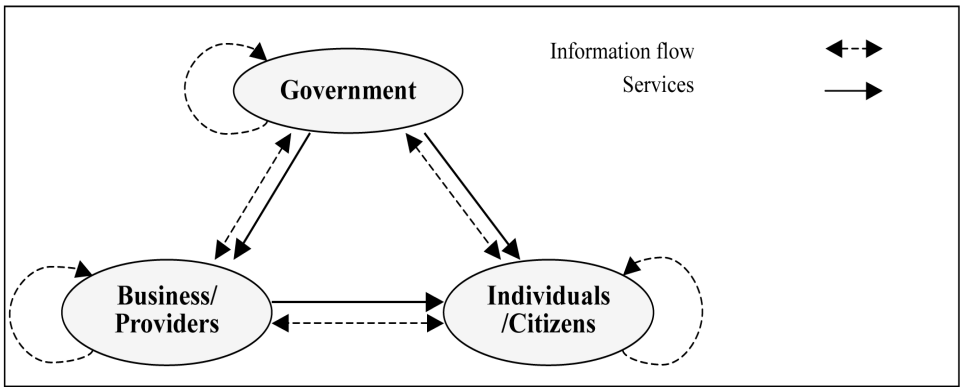
Individuals/citizens: Customer-to-Customer (C2C), including the establishment of virtual health networks and e-learning communities to enhance their empowerment. Business-to-Customer (B2C), focusing on delivery of data, information, knowledge, product and serves directly to consumers. Government-to-Citizens (G2C), making it easy for citizens to access high-quality healthcare information.

Business/providers: Business-to-Business (B2B), connecting different information systems among e-vendors, e-caregivers and e-payers to achieve the effective and efficient healthcare services delivery by connecting different information systems among e-vendors, e-caregivers and e-payers. Government-to-Business (G2B), eliminating redundant collection of data and better leveraging e-business technologies for communication and surveillance to reduce government's burden on service providers by eliminating redundant collection of data and better leveraging e-business technologies for communication and surveillance.

Inter- or intra-governmental: Government-to-Government (G2G), integrating public health with Information and Communication Technologies (ICT) and e-health technologies to provide timely availability and quality of information. Moreover, interconnecting all e-stakeholders to work together eliminating disparities across geographical, socio-political, cultural and time difference barriers.

E-healthcare information systems based on e-business model creates a new relationship among stakeholders (see Figure 1). Applications in e-health should be easily accessible to serve the general public and all stakeholders. However, information systems implementation failure occurs mainly because organisations could not manage the politics of information adequately; especially healthcare organisations as they are in particular political in nature (Fehse and Krabbendam, 2004). The strategic roles of the government from the demanding supplying perspective or the direct indirect involvement perspective should change in different stages of e-infrastructure development (Yu and Fang, 2005). Consequently, we have proposed the IOSs perspective and conceptual framework that guides the empirical study of all functions in and around the e-health projects.

Figure 1 E-healthcare information systems relationship



3 Developmental stages of e-health

3.1 The nature of IOSs

Literature with a technical view on the IOSs started in the 1980s. Cash and Konsynski (1985) gave a simple but a useful definition of an IOS as "an automated information system shared by two or more companies". They considered the system to be useful for the participants to improve upon their productivity system, flexibility and competitiveness. Johnston and Vitale (1988) further improved it as "an IOS built around, computer and communication technology, and facilitates the creation, storage, transformation and transmission of information". Actually, IOSs are ICT-based systems that transcend legal enterprise boundaries (Kumar and van Dissel, 1996).

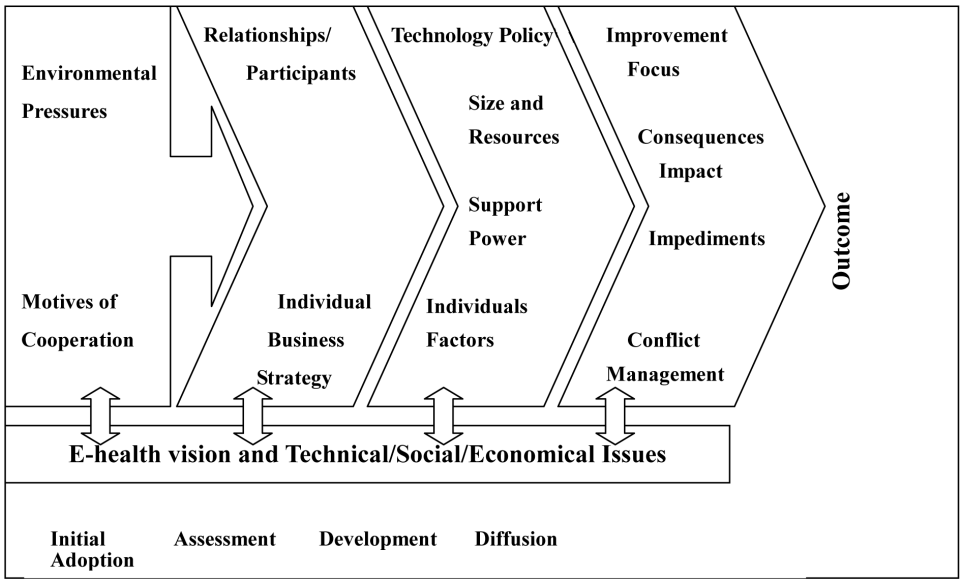
Many IOSs are implemented using different technologies that include: e-mail, Electronic Data Interchange (EDI), exchange of product design information (Computer-Aided Design (CAD), etc.) and access of database directly from other organisations. Technically, the most common method to implement IOS are either through online connections or message exchange. For example, Holland (1995) illustrates the role of an IOS that was used in a process for a CAD system that was developed to reduce the manufacturing design cycle and provide better service to the customer. Bakos (1991) mentioned that there are three characteristics that are associated with IOSs. Firstly, it decreases the costs of exchanging and acquiring information about participating firms. Secondly, the benefits accruing for the IOSs innovator increases as the number of firms joining the network increases. Finally, considerable switching costs do occur when a firm switches over from one IOS to another. Christiaanse and Venkatraman (2002) test the SMARTS in electronic channels showing the necessity to extend the theoretical perspectives on IT-induced inter-organisational relationships from an efficiency perspective to an expertise point of view.

As traditional perspectives are inadequate for further prospects and in building customer-driven, future linked e-health information system, so the IOSs perspective is an alternative. In fact, the essential characteristics of an IOS are multifaceted, after the emergence of techno-economic and socio-political perspective, the trust and relationship perspective was also mentioned (Kumar et al., 1998). Considerable efforts should be taken to understand and in analysing the socio-cultural factors that affects the e-healthcare information system (Mieczkowska et al., 2004). For this reason, there is a change in the role of IT – changing from a source of competition to that of a source of cooperation among businesses (Hong, 2002). IT is now used as a source of cooperation rather than that of competition among firms. Participants in IOS not only include suppliers, customers, dealers but also competitors (Hong, 2002; Johnston and Vitale, 1988). It is therefore necessary to view the IOSs in a broader context, as IOSs can be considered as a well planned and effectively managed cooperative venture among otherwise independent agents (Kumar and van Dissel, 1996). However, as an IOS is changed from a competition-based role to a collaboration-based role, except competitive advantage, the value of trust or conflict management issues in the system will also increase.

3.2 The four-stage framework and criteria

The importance of developing a four-stage framework is to provide a better understanding of the role of IOSs in e-health. As these stages steering cycle clearly shows the 'policy values' aspects (Rochet, 2004), a practical information roadmap for identifying problems and implementing timely corrective actions provides a vital informations integrated approach and improves projects' success (Czuchry and Yasin, 2003). On the basis of these past contributions, we proposed a conceptual framework of IOSs, which relates these set of goals and issues in e-health. The conceptual framework describes different stages of IOSs development and proposes a 'stage of growth' framework for a fully functional e-health information system. These stages outline the multiperspective transformation between government and participants system structures and functions as they permit transitions to e-health through each stage. Elements and criteria of each stage of framework are depicted including initial adoption, assessment, development and diffusion (see Figure 2). The detailed information about each stage are summarised in the Appendix.

Figure 2 Stage framework for IOS



Initial adoption: the initial stages of adoption can be better understood by separating two driving sources. Firstly, driving source from outside is already mentioned in many papers. These environment pressures come from not only globalisation (Kumar and van Dissel, 1996) but also customer empowerment (Gover, 1993). The institutional theory has been a good perspective to help to understand these pressures in e-health when investigating IOSs adoption (Teo et al., 2003). Finally, driving source from inside basically is as follows: the IT-enabled services, such as competition, risk sharing, reducing uncertainty and adaptable innovations. However, companies would like to adopt an IOS only when the results could conform to their economic benefits (Kumar and Crook, 1999). The core value proposition for e-health in this stage is to confirm the

reasons as to why the stakeholders should be. The e-health vision is responsible for the e-government to overcome bureaucratic and political hurdles, and take major initiatives for implementing e-healthcare information systems successfully (Im and Seo, 2005). These strategies for developing the e-health vision in e-government are based on their knowledge of the subject and other relevant resources available to Governments. Governments can communicate these strategies to the practitioners through the use of practical guides (Gil-García and Pardo, 2005).

Assessment: the academic literature that discusses IOSs is massive and applies many theoretical perspectives to view and analyse issues regarding the use of IOSs within inter-organisational relationships. Recognising these relationships as an assessment will help us to make inferences on the linkage of roles enacted in joining the e-health. The organisations involved would approach IOSs with different and often conflicting goals, and also they may pursue their own self-interests at times (Bakos, 1991). Therefore, it is very difficult to achieve the fullest cooperation in the beginning. Decisions and analysis should start from the strategy of individual businesses, and these initiatives are necessary for full realisation of the policy of IT in the next stage. Assessment should be based on both integration (from sparse to complete) and technological and also organisational complexity (from simple to complex). Collecting the information about different stages and identifying the functions (Siau and Long, 2005), the government's strategies can be classified into three broad subcategories: coercion, support and building long-term relationships (Kumar and Crook, 1998). The core value proposition for e-health in this stage is to make sure who are all responsible for and who should be involved. Each participant in e-health should be aware of the competition and the market conditions. The integrative framework and preparedness grid could provide useful and necessary tools for evolving successful e-health initiatives to ensure in helping stakeholders to identify and thus identify areas that require further attention for undertaking a successful e-health initiative (Wickramasinghe et al., 2005).

Development: once the fermentation takes place, strategic focus is on to seek the content of e-health. On the basis of the e-business models to be developed and designed the different groups for the e-healthcare services delivery, four important elements and criteria should be confirmed. Firstly, technology policy focuses on either improving the services provided to the existing businesses, or transforming the business through new technological innovations (Olga et al., 1999). However, the technology policy is a multidisciplinary one. For example, security is also a collaboration issue since the trading partners have the same degree of concern for security and must agree on methods of enforcing security. Security is also an organisational issue since managers and auditors should be made comfortable with security procedures (Kumar and Crook, 1999). Another example is the standard of the e-health, such as coding of the electronic health records that is compatible with ICD9 and the others. Secondly, larger organisations tended to be more complex in developing IOSs (Kumar and Crook, 1999). Size and resources often become control variables and to avoid their influence on IOSs research (Teo et al., 2003). Thirdly, successful design and development requires leadership at each stage of development (Olga et al., 1999). The leadership had the description of two types of support role: a top-management and project management. It is different from the level of support it has in this paper because the support level means the technical support level of business information system infrastructure. Finally, individual factors to be included are not only patients but also physicians. Factors that relate to an individual's

perception and the use of e-health must be considered (Kumar and Crook, 1999). Scenario analysis will consider the technical, social and economical issues in this stage. However, the Government plays a key role so as to promote e-health and reduce the health disparities in the next stage.

Diffusion: the core value proposition for e-health in this stage is to make sure that integrating participants to work together and face the changes. After the implementation of e-health information systems, a continuous refining process is necessary to make sure of sustainability. The factors causing impediments to IOSs affect not only the adoption (Gover, 1994) but also the implementation. For example, a physician unwilling to use the internet technology for delivery of services is quite often found out in many researches. The shortage of information intensity, over organisation's complexity or incompatibility will affect the success of e-health. Moreover, the participants should focus not only on the continuing improvement but also on the consequences of impact. It is useful to mention that in the implementation stage to consider these different effects in e-health among industry, organisations and individuals. This stage, Kumar and van Dissel (1996) highlights the conflicts and risks that could emerge in the context of IOSs and emphasise the need to manage these risks. Factors such as power and training among the partners have also been identified as influencing the usage of IOSs (Kumar and Crook, 1999). Understanding the negative consequences can help mediate distress to the satisfaction of all concerned parties and facilitate in the opportunity of e-health success. To improve upon patient care and enhance patient satisfaction, strategies and exploration of operational issues are necessary for creating a successful e-healthcare information system (Paulson and Snyder, 2005).

These technical, social and economical issues in e-health sometimes are competitive and complementary; and interact with each other. It means these issues in each stage will continue or intensify. As the positivist case study (Sarker and Lee, 2003) provided support for the social enablers in ERP implementation, literature on e-health information systems related with IOSs perspective also gives equal consideration for the technical and social dimensions, expands to the political and economic dimensions and their interactions. Three important e-health information system projects in Taiwan will progress as context analysis. The case study (Yin, 2003) will collect the evidence among secondary data, documents, archival records and conduct of interviews to support the framework.

4 Context analysis to illustrate the proposed model

The Department of Health (DOH, 2005) of Taiwan operated their national insurance programme under a single public owned organisation – Bureau of National Health Insurance (BNHI). The programme, which started on 1 March 1995, had set an original goal of universal coverage, equitable access to quality healthcare and at an affordable cost. The National Health Insurance (NHI) of Taiwan covers 23 million citizens with an annual outlay of some 13.5 billion US$. A key factor to the success of the programme is the adoption of information system from its inception. Meanwhile, the DOH already spent about 2 billion US$ to create the Health Information Network (HIN) from 1988 to 2004. It is surprising that this project includes several IOS systems: the infection case announcing system, the serious diseases bed check, the long-term care system, telemedicine and so on (Chang, 2003), but all did not work very well. The most

important problem is on the diffusion stage. These e-health systems still struggled for the implementation. Even when SARS came, the HIN still did not enhanced or glorified. The shortage of e-health goals and poor vision resulted in. On the other hand, every citizen and foreigner who is eligible for the NHI programme has received a smart card (IC card) from 2002 (BNHI, 2004a). The system costing 150 million was well designed until 1 January 2004. This technology is from Germany, the same company which prints the Euro. It is now used only as a health ID; however, it has the potential of storing some medical information over there. The IOS of this project based on XML was created and implemented by the government and the TECO. At this moment, the government and other stakeholders still debate what information is suitable to be put into the smart card so as to facilitate data inter-exchange among healthcare providers and access to patients. However, the successful implementation of this project has already achieved its first goal of connecting all healthcare providers under a single network (BNHI, 2004b). The impediment to the implementation of this project is mostly from the fear of infringement to privacy and security issues. As this project was a success, DOH released the national blueprint for e-health in Taiwan and announced a investment of 300 million NHII project in 2005 to be undertaken over the next four years in the NHII project. The IOS structure of the Smart Card project is different from NHII project as the type of interdependence: pooled and reciprocal (Kumar and van Dissel, 1996).

Although the success in Smart Card project was diversified, still it can be tracked. In the initial stages of adoption, the environmental pressures and the motives for cooperation are clearly described in this case. The stakeholders need this project because it can be used for both preventing the fraud and abuse in healthcare. Formation of cooperative alliances is easy to understand. In the assessment stage, in spite of different innovators, IOS framework can be applied. The reason is that not only because they have the same organisational strategy but also the participants in IOS believe that these information and communication technology-based services are used. Then, in the stage of development, the project designs the IOS already including integration, flexibility, standards and trust-based system. The support power in this case is also obvious. However, compared with the HIN project, it is quite interesting as to why the outcome is so different in the last stages. Kumar et al. (1998) developed an additional theoretical perspective in order to better explain this question. The success in the Smart Card Project is due to the collaboration of the participants in each stage which means that the trust mechanism already been established. Even though, there were some problems, the participants believe that the testimony to the importance of social consensus, is critical when we want to achieve the original goal of sharing health records electronically. For this reason, the NHII project can be developed by the virtual private network of the Smart Card Project and still the security criteria shall be the most important issues in future. The focus on challenges of trust building in e-governance, ICT management and privacy and security will continue (Palanisamy, 2004).

The interactive effect of information needs and capability has a significant effect on performance (Premkumar et al., 2005); the e-health cases in Taiwan also support these findings. However, the issues as regards the framework released for each elements and development of criteria are not only technical but also political and economic in reality. For example, the security and privacy criteria already developed in these e-health cases includes not only the cost and ability but also the trust. Accordingly, the results of these cases in Taiwan shows that, political issues are always more important than the technical and economical issues.

5 Issues for research and managerial implications

Literature on IOSs mainly focuses on the case study to support the reasons for the success or failure. These researches had already presented valid reasons to convince the readers. However, to compare with two IOS famous cases, the Prato case (Kumar et al., 1998) and the Japanese Airline case (Chatfield and Bjorn-Andersen, 1997), it is very difficult to explain their different outcomes. The system's dynamic perspective may provide a good answer because the issues in each stage are competitive and complementary, any micro issue may lead to a change in the outcome. Even 'technology policy', 'size and resources' and 'support power' were also prepared well, just because the importance of individual factors were not considered, the Prato case was a failure. On the contrary, the Japanese Airline case was a success not only because they solved the problems well in each stage but also they possessed valuable information. These issues will become the most important criteria for the success of those IOS-related e-health information systems. Although the e-health environment is highly dynamic and complex in nature, especially in the diffusion stage; it is really very difficult to predict the effects and outcomes. The proposed framework illustrated in this research in comparison with those cases in Taiwan could support the stakeholders to utilise their opportunities and meet their challenges in e-health.

5.1 Beyond the model

Challenges from e-health implementation will be substantial and complex. Accordingly, Johnston and Vitale (1988) categorise IOSs based on business purposes, participants, information function and focusing on improvement. Other scholars proceed with different topologies (Hong, 2002; Kumar and Crook, 1999; Kumar and van Dissel, 1996). Based on the above-mentioned researches and suggestions, the framework in this research goes through various stages and addresses the major issues and criteria to help researchers and practitioners to focus on their goals during the course of development and implementation of e-health information systems. And it will be valuable for future study in the process-based analysis. Forecasting systems can help government in this rapidly changing cyber world but still need to revive (Nikolopoulos et al., 2004). However, the management of IOS's by organisations has proved to be difficult and complicated. Researchers should pay more attention in the hybrid business model and services in e-health and this stages reference framework is still required to be refined in e-health domains.

5.2 IOSs leverage

Another key concept for future research in e-health is the IOSs leverage. Kumar and Crook (1998) already described the consequences that affect the individual, organisation and industry. The results in Chatfield and Bjorn-Andersen's research (1997) illustrate a business process change enabled by IOS could also extend to e-health information systems. The infrastructure technology is more powerful as there will be more sharing and usage (Carr, 2003). However, from the context analysis, issues in each stage are not always coordinated. As public administrators, integrating technological, social and economic issues in e-health is not easy, the way is to work only

when the patients benefit and eliminate the health disparities at first. Future research may develop a context for understanding the points of leverage and their creation provides a perspective of reconciliation for organisations and managers in the midst of escalating IOSs issues and radical changes in e-health. Meanwhile, the IOSs perspective should cover not only to help in the development of and diffusion of technological issues but to promote the innovation in e-health environment. For example, the researches in electronic health records try to find high-quality and low-cost solutions right now, still, somewhat not enough. The more important vision is to improve the new business model in e-health and to invite more participants and transition within traditional healthcare structures.

5.3 Opportunities and challenge for e-health stakeholders

E-health core value propositions are not only for reengineering business processes and reduce administrative and clinical costs, but also to increase customer empowerment and satisfaction, strengthen patient–provider–government relationships. Kumar and Crook (1998) already described the consequences that will affect the individual, organisation and industry. As an IOS is extended from a transaction role to a knowledge-based role, the issues of trust between the business partners must be increased. And the relationships improvement should focus on G2C, G2B or hybrid model except B2C (Pennington et al., 2004) and C2C (Leimeister et al., 2005). This requires sufficient time periods to move from deterrence-based trust to the identification-based trust stage, not only to consider the efficiency perspective, but also trust is a most important challenge in G2C, G2B model.

The management of IOS's e-health project in Taiwan has proved to be difficult and complicated. The stages reference framework is conducive to the practice of focusing their vigour on every issue, and the development and implementation of e-health will go through various stages and will be helpful during each stage. Compared with other industries, most healthcare providers in Taiwan were lacking in flexibility to renew their HIS or intranet services. The e-health project must reduce the impacts among the different participants. According to the conceptual model of supply chain flexibility (Ducios et al., 2003), their flexibility includes not only operations system but logistics, supply, organisational and information systems. For this purpose, the e-health project's associates must try to reduce the impact among the different participators.

The e-health project enablers should take more efforts in updating project's information efficiently. Based on the reference framework, data can be collected to assess the quality of the project and adjust the policy as early as possible. It provides guidelines for comprehensive measures to assess e-health in e-government implementation (Sharma, 2004). A team has already been formed by DOH in Taiwan to build a working guideline that helps to manage and monitor the e-health projects. In addition, benchmarking studies is useful for project planning and method selection. Consultants could develop some useful tools for these e-health information systems. The public administrators should develop a mechanism supported by consulting not only supports the project management itself but also a scoring system that helps in managing the project management, monitored by an agency to collect data for central database.

6 Conclusions

The quality of government's health information infrastructure projects was hardly evaluated, a four-stage reference framework could be the beginning. It is interesting to note that in some places where healthcare delivery system are still in their developing stages as most Asian economies are, their chances of developing a foolproof e-health delivery system could be higher than in countries with established healthcare systems. The already informed e-ready is available there and the number is increasing very rapidly. There is no time to contemplate on one strategy after another without delivering the real output – the promised NHII or whatever name under which the modern e-health could be based upon. The culture issues have already been initiated at different levels of academic and practitioners' conferences on e-health. Accordingly, the need to empower and promote patient care still cannot get enough information from the e-health information systems. Using the stage reference model, the practice could be carefully to avoid those mistakes in the NHII project. However, the impact of IOSs is not only technical but also social and economical (Hsieh and Lin, 2004), and more important is an alternative and their interaction. This is a chance to build a managing or monitoring agency to help those projects.

As e-health impacts are radical IT-based changes across organisations, the vision of stakeholders within e-health includes government, healthcare providers and information system suppliers is to reduce administrative cost and improve customer satisfaction. In the rapidly changing and unpredictable environment, government as an enabler or leader should have the humble attitude and integrate team members as partners to continue survey and create a feasible method, project will fail not in content but in the method. Effective delivery strategies and supporting technologies will be benefited. Healthcare providers care about core competition and the opportunities in e-health. Information system suppliers should understand the different requirements of IT among project-organisation-inter-organisation and bring the virtual team together. Otherwise, IT does not matter. The key issues to be followed, identified and addressed: e-health trends, e-health evolution, e-health usage, e-health governance, e-health services delivery, connectivity, readiness, citizen participation, e-health technology, change management and funding needs. More research and practices involve, more cumulative evidence of impacts and effects of e-health on individuals, groups, communities and populations, which will contribute to the paradigm shift.

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Appendix

Summary issues of the four stages

Initial adoption		
Environmental pressures	Globalisation	Kumar and van Dissel (1996)
	Customer power	Gover (1993)
	Mimetic, coercive, normative pressures	Teo et al. (2003) and Kumar and Crook (1999)
Motives of cooperation	Reaction to competition	Johnston and Vitale (1988), Gover (1993) and Kumar and Crook (1998)
	Risk sharing and reducing uncertainty	Kumar and van Dissel (1996)
	Adaptable innovations	Gover (1993)
	Economic factors	Kumar and Crook (1999)
Assessment		
Relationships/participants	Innovator	Kumar and Crook (1998) and Hong (2002)
	Participants (customer, dealers, suppliers and competitors)	Johnston and Vitale (1988) and Hong (2002)
Individual business strategy	Awareness of competition and market conditions	Johnston and Vitale (1988) and Gover (1993)
	Customer services	Johnston and Vitale (1988)
	Switching costs	Johnston and Vitale (1988)
	Coercion, support, collation	Kumar and Crook (1998)
Development		
Technology policy	Integration	Kumar and Crook (1998) and Kumar and Crook (1999)
	Support level	Hong (2002)
	Internal use	Johnston and Vitale (1988) and Kumar and Crook (1998)
	Standards	Kumar and Crook (1999)
	Security	Kumar and Crook (1999)
Size and resources	Availability of resources	Kumar and Crook (1999)
	Skilled the technical workforce	Kumar and Crook (1999)
	Size of the organisation	Gover (1993) and Kumar and Crook (1999)

Appendix (continued)

Development		
Support power	Top-management	Gover (1993), Kumar and Crook (1999) and Olga et al. (1999)
	Project championship	Gover (1993), Kumar and Crook (1999) and Olga et al. (1999)
	Senior management commitment	Kumar and Crook (1998)
	Existence of communication channel	Kumar and Crook (1999)
Individual factors	TAM, etc.	Kumar and Crook (1999)
Diffusion		
Improvement focus	Transaction cost	Johnston and Vitale (1988) and Kumar and van Dissel (1996)
	Efficiency	Johnston and Vitale (1988) and Kumar and van Dissel (1996)
	Trust	Kumar and van Dissel (1996)
Consequences impact	Industry, organisation, individual	Kumar and Crook (1998)
Impediments	Information intensity	Gover (1993)
	Complexity	Gover (1993)
	Incompatibility	Gover (1993)
Conflict management	Power, training, etc.	Kumar and Crook (1999)