COMPLEMENTARITIES BETWEEN RELATIONAL AND CONTRACTUAL GOVERNANCES IN E-HEALTH ABSORPTIVE CAPACITY

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Abstract

As healthcare organizations rely more heavily on IT, there is a growing need to understand innovative IT use in these organizations. First, this research introduces the concept of e-health absorptive capacity which consists of e-health entrepreneurial alertness, assimilation and exploitation, based on Cohen and Levinthal (1990)’s absorptive capacity theory. We then address the theoretical neglected question of how and why the e-health entrepreneurial alertness influences e-health exploitation. Finally we use the theory of transaction cost economics to identify relational governance and contractual governance and theorize the relative impacts of the relational and contractual governances across e-health absorptive capacity processes. Based on data collected from the 182 senior management from104 healthcare organizations, we found 1) greater e-health entrepreneurial alertness enhanced e-health exploitation in the e-health context by enhancing e-health assimilation, 2) relational and contractual governances each had a stronger impact on e-health absorptive capacity, 3) relational governance had a stronger impact on the early stage (i.e., e-health entrepreneurial alertness) of the absorptive capacity process than contractual governance and contractual governance has a greater impact on the later stage (i.e., e-health assimilation and e-health exploitation) than relational governance. Our findings provide insights on concern with e-health capability development and managing e-health implementation.

Keywords: E-health absorptive capacity, E-health entrepreneurial alertness, E-health assimilation, E-health exploitation, Relational governance, Contractual governance.
1 Introduction

Today, the healthcare environment is undergoing significant transformations. Most healthcare organizations face the need to lower costs, enhance service quality, and make use of rapid advanced information technology (IT) in clinical procedures to deliver innovative services (Garg et al., 2005). IT has been considered as the main catalyst in stimulating transformations that trigger considerable changes in business processes and performance outcomes (Markus, 2004; Straub and Watson, 2001). The use of IT in healthcare is referred to as electronic health (e-health), which is defined as “the cost-effective and secure use of IT in support of health and health-related activities” (WHO, 2005). A variety of e-health applications and innovations have been implemented in healthcare systems, such as healthcare information system, electronic medical records (EMR), and picture archiving and communication system (PACS). These innovations involve the use of IT to support the administrative and professional service core of e-health.

Successfully implementing IT in healthcare is now recognized as a requirement for running a sizable healthcare business and for being connected to other entities in a networked healthcare delivery system. It is widely accepted as the new paradigm for delivering effective and high-quality health care services in a cost-effective way. Modern health organizations are composed of intensely interrelated social and technical elements, where changes to one aspect may influence the others (Wears and Berg, 2005). The introduction of new IT in the healthcare context necessitates innovations in patient-physician relationships, clinical roles, and healthcare processes, while simultaneously reinforcing the capacity and utility of technology (Chao et al., 2007). As healthcare organizations continue to rely more heavily on IT, there is a growing recognition in the healthcare community of the importance of innovative IT use in healthcare. However, the implementation of e-health initiatives has often been problematic, as many have failed to demonstrate their anticipated benefits (Murray et al., 2010). The complexity of IT implementation in integrated healthcare delivery systems requires the coordination of diverse resources, including manpower, medical materials, healthcare processes, and the relevant technical components. Therefore, it is critical for healthcare organizations to figure how to develop e-health capability which facilitate e-health exploitations. These innovations require healthcare organizations to continually acquire and evolve new sets of e-capability to identify, choose, converge with and reconfigure integrated sets of resources vital to adopting e-health.

Thoughtful implementation of e-health is necessary in order to yield full benefit to patients and stakeholders. Gaining the benefits from e-health exploitations requires a fundamental restructuring of care delivery, which appears to be a powerful force for change in the healthcare industry today. For those healthcare organizations that have embarked on e-health activities with limited success, the adoption of e-health has become more complicated and challenging. Most healthcare and IT-related research has focused on the technology developments and clinical applications essential to successful implementation in the healthcare environment. However, the research has not paid sufficient attention to identifying and examining potential facilitators of e-health exploitation (Murray et al., 2011). More than ever, IT implementation fails because of the organization’s lack of preparedness for change. The purpose of this research is therefore to address the following two research questions: (1) What factors contribute to e-health exploitation in contemporary healthcare organizations? and (2) What factors facilitate e-health absorptive capacity in the healthcare sector?

2 Theoretical Foundation and Model Development

2.1 Absorptive capacity theory and e-health absorptive capacity

Absorptive capacity is conceptualized as the dynamic capability to recognize the value of new external knowledge, and to assimilate and apply it to commercial ends. Accordingly, it consists of acquisition, assimilation, and exploitation capabilities. An organization’s absorptive capacity indicates its ability to
recognize the value of new (external or internal) knowledge, and to assimilate and apply it effectively for economic benefit (Cohen and Levinthal, 1990; Malhotra et al. 2005). Absorptive capacity may thus contribute significantly to a firm’s sustainability and its long-term ability to innovate. It facilitates a sort of re-creative process of a firm’s knowledge, and is critical to an organization’s innovativeness.

In order to survive and prosper, healthcare organizations must balance the demands of its competitive environment with its internal management systems. Modern healthcare organizations must therefore be constantly aware of changing political trends, economic changes, the development of new public health laws or regulations, and social realities (Parkin, 2009). If healthcare executives can respond well to their internal and external environments, their organizations will transform over time (Smaltz et al., 2006). In that sense, such a capability can help healthcare organizations to anticipate and visualize healthcare deficiencies, while at the same time evaluating opportunities for IT-based competitive actions. It functions as a mechanism for identification and acquisition of emerging technologies for e-health, by providing time for learning and acting at the speed at which the healthcare industry changes. Accordingly, in this study we refer to e-health entrepreneurial alertness as the extent to which a healthcare organization can sense threats from competitors and changes in the environment, technology, and policy, in order to enable new, superior business strategies that capture the opportunities presented by e-health (Wu et al., 2006).

Underpinning the logic of absorptive capacity, e-health entrepreneurial alertness is the critical capability of an organization to explore its marketplace and detect areas of current and future threats and opportunities. In other words, it is the ability to anticipate discontinuities, threats, and opportunities in the future, while increasing a firm’s vigilance of marketplace dynamics (Agarwal and Selen, 2009). Based upon the concepts from Cohen and Levinthal (1990), such a capability can facilitate healthcare organizations in visualizing the relationships between novel IT and business activities, enabling the organization to acquire new healthcare technologies to effectively react competitively to the environment and emerging market opportunities (El Sawy and Pavlou, 2008). Therefore, e-health entrepreneurial alertness is expected to facilitate healthcare organizations in assimilating innovative uses of e-health technologies by enabling them to align clinical and care delivery system with e-health, converge e-health with management competence to develop services and employ e-health to develop new care services. Moreover, it may help healthcare organizations develop an integrated set of core e-health capabilities for exploiting e-health and undertaking the actions needed to implement those capabilities. Thus, we propose:

**H1a: E-health entrepreneurial alertness is positively associated with e-health assimilation of a healthcare organization.**

Essentially, today’s healthcare reforms have begun transforming health care into commodities and products. It consists of the efforts and processes of introducing e-health into a healthcare organization, and providing innovative healthcare services and connections to consumers, employees and partners. It also involves the creation of new value in terms of providing e-medical products and services. Patient care must be delivered by healthcare information systems that are carefully and consciously designed to be safe, effective, and patient-centered. As a result, it is critical for modern healthcare organizations to create new value by exploiting e-health initiatives which successfully integrate clinical and care delivery systems, enhance relationships with patients, develop new care services, create partnerships with other stakeholders, and make long-term profits (Dedding et al., 2011). In this study, e-health exploitation is defined as the extent to which a healthcare organization/hospital can creates innovative values of care services to customers and stakeholders through the exploitation of e-health technologies. It is likely to help healthcare organizations provide the capability of exploiting new e-health technologies when subjected to varying patient needs, thus arming the health care staff with the ability to spontaneously deliver customized solutions to customers (patients). Drawing on the theoretical lens of absorptive capacity, e-health assimilation may help healthcare organizations in using e-health innovatively to make profits, reconfigure e-health resources to create values and implement appropriate e-health processes in the healthcare environment. Thus, we propose:
**H1b:** E-health assimilation is positively associated with e-health exploitation of a healthcare organization.

### 2.2 Mediating Role of e-health assimilation on the relationship between e-health entrepreneurial alertness and e-health exploitation

The mediating role of e-health assimilation in explaining how and why e-health entrepreneurial alertness results in improved e-health exploitation represents the third element of the proposed tripartite relationship. An increase in e-health entrepreneurial alertness allows the focal hospital to increase its e-health exploitation relative to its competitors primarily because such entrepreneurial alertness increases e-health assimilation. When focal hospital has better capability to be aware of e-health technology, regulation, and policy which affect care services, acquire emerging IT, identify its opportunity in the healthcare services, its health processes or administrative services are better able to cope with barrier in integrating these services with IT because of the vision and motivation that such entrepreneurial alertness create. Such entrepreneurial alertness also increases the likelihood that the activities of the e-health services are better synchronized with market trend and patient demands. They also allow more rapid exploitation of e-health innovation. The e-health exploitation benefits of entrepreneurial alertness, therefore, arise primarily because such entrepreneurial alertness enhances e-health assimilation. This presents the third of our tripartite argument that complements the two preceding hypothesized positive effects of e-health entrepreneurial alertness on e-health assimilation and of e-health assimilation of e-health exploitation. This leads to our following hypothesis.

**H1c:** E-health assimilation mediates the positive effect of e-health entrepreneurial alertness on e-health exploitation of a healthcare organization.

### 2.3 Transaction cost economics and antecedents of e-health absorptive capacity

When considering the influence of external social, technical, and political environments on Information technology outsourcing such as for health technology assimilation and exploitation in health sector, the theory of transaction cost economics (TCE) is especially salient. Transaction costs, often known as coordination costs, are well defined as the costs of all the information processing necessary to coordinate the work of people and machines that perform the primary processes. In response to the changing environment, TCE is a common principle for understanding how managers craft governance arrangement. The general proposition of TCE literature indicates that managers align the governance features of inter-organizational relationships to match known exchange settings associated with uncertainty or asset specificity investment. For instance, managers may craft formal contracts that define remedies for foreseeable contingencies or specify processes for resolving unforeseeable outcomes in response to exchange hazards (Poppo and Zenger, 2002). Drawing on the literature on the aforementioned theories, we complement the absorptive capacity perspective with the transaction cost economics of the firm to derive the relational governance and contractual governance constructs that influence the e-health absorptive capacity. While both relational and contractual governances could be important for absorptive capacity processes, IS researchers have suggested that as these two constructs differently, their impacts may also vary significantly depending on the stages of the absorptive capacity processes. Accordingly, we examine the impacts of each of the two constructs, theorize the relative impact between these two construct on e-health entrepreneurial alertness, e-health assimilation, and e-health exploitation.

#### 2.3.1 Relational governance and its influence on e-health absorptive capacity

Relational governance involves developing the understanding of health care professionals of the potential for e-health, and helping health care and IT professionals to work together in ensuring health care user ownership and satisfaction (Tierney et al., 2010). It can effectively facilitate wider dialogue between healthcare and IT communities. Prior research has pointed to the difficulty in achieving this
dialogue, and made reference to the culture gap between “techies” and “users” (Feeny and Willcocks, 1998). While this gap may occur in delivering health care services, it is necessary for healthcare organizations to build and facilitate collaborative relationships between both sides. Essentially, the healthcare and IT spheres can collaborate in strategic, tactical and operational facets. Some e-health processes may still remain purely health care or technology, but most activities intertwine healthcare and technology such that the two become indistinguishable. The aim is to use constructive dialogue to bring together people who previously found it difficult to communicate with each other, thereby planting the seeds for new opportunities and encouraging farsighted implementation of innovative e-health opportunities (Tseng and Chen, 2007).

To choose emerging IT, convey new IT insights and match with economic opportunity, communicate IT initiatives and execute e-health innovation for growth to maintain competitive advantage, it is necessary for IS professionals to understand, participate in, and support the critical professional activities of their health care partners. Also, health-care professional need to realize the potential that e-health holds for them. Drawing on the concepts of IS capabilities from Willcocks and Feeny (2006), we defined relational governance as the ability of a healthcare organization to facilitate wider dialogue between health care and IT communities with the goal of making both sides work together, thus ensuring their ownership and satisfaction. The concept of relational governance can well reflect the creation of mutual confidence, harmony of purpose, and successful communication between the health care and IS people in responding to changing healthcare surroundings.

2.3.2 Contractual governance and its influence on e-health absorptive capacity

Healthcare enterprises are increasingly operating a growing number of delivery sites that are widely scattered and are equipped with dissimilar e-health platforms. Hoque et al. (2006) proposed a networked governance model of business enterprises and argued that the technology contracting capability can help companies lower their costs of service provisioning, augment their existing proficiencies, and leverage the building of new business capabilities that can respond to new threats, vulnerabilities, or regulatory demands. It is also fundamental to the logic of leveraging external complementary resources, which includes the establishment and maintenance of relationships with strategic partners, such as suppliers, customers, and other key stakeholders (Agarwal and Sambamurthy, 2002; Kale and Singh, 2009). It is a critical capability that largely reflects the knowledge sharing, communication, and learning abilities of a firm. This provides the ability to build, change, or mobilize resources and assets through the establishment of technology contractual governance (Kale and Singh, 2007; Xia and Roper, 2008).

To effectively achieve e-health exploitation, healthcare organizations must possess strong health technology contracting capability to help them lower costs, augment their existing business, and consider the innovative uses of e-health technologies (May, 2009). As such, health technology contractual governance stands for the ability of a healthcare organization to ensure the success of contract for IS/IT services and manage the IS/IT sourcing strategy that meet its interests. It can provide healthcare organizations with the capability to reconfigure resources, tasks, and activities on short notice, which in turn leads to greater flexibility and customization, as well as more efficient service delivery (Agarwal and Selen, 2009). Also, the integration of e-health technologies with health care processes provides greater reach and richness of information and knowledge sharing among business partners, thus creating sound e-health infrastructures in terms of emerging technologies, procedures, and collaborative relationships.

2.3.3 Relative Impact between relational and contractual governances on e-health absorptive capacity

Our research model is shown in Figure 1. While both relational and contractual governances could be important for e-health absorptive capacity, researchers have observed that contractual and relational governances different significantly, their effects may also vary significantly depending on the focal...
behavior and the context (Poppo and Zenger, 2002). To develop a richer understanding of how these two governance constructs influence the three absorptive capacity processes, we theorize and propose comparative hypotheses on the differential (and the most) effects of relational and contractual governances on e-health entrepreneurial alertness, e-health assimilation, and e-health exploitation.

A healthcare organization needs to sense threats from competitors and changes in the environment, technology, and policy, acquire the emerging technology in order to enable new, superior business strategies that capture the opportunities presented by e-health. Acquisition refers to firm’s capability to identify and acquire external knowledge that is critical to its operations. Yli-Renko, et al., (2001) have suggested that repeated interactions with other firms enhance the ability of firms to evaluate and acquire pertinent knowledge from other firms. Following this logic, when a healthcare organization has a better social relationship with other firms in supporting work and providing opportunity, information or knowledge that is critical to its operations, it will be better off in alertness. Because as compared to contractual governance, relational governance occurs through social processes that promote norms of flexibility, solidarity, and information exchange. These facilitate problem solving and adaption. In addition, as argued earlier, contractual governance will contribute to e-health entrepreneurial alertness. However, at this initial stage, contractual governance does not have a salient role as relational governance has.

According to the logic of TCE, the manager’s task is to craft governance arrangements to match the exchange conditions that accompany various services with minimal cost that ensure the delivery of the desired quality, price, and quality of a supplier’s services. Scholars pointed out three categories of exchange hazards: asset specificity, measurement difficulty, and uncertainty (Poppo and Zenger, 2002). As the absorptive capacity process move from entrepreneurial alertness to e-health assimilation and exploitation, this may involve business process reengineering (BPR) and technology changes, thus the need for asset specificity and the level of uncertainty arise. Uncertainty challenges an exchange by requiring the parties to adapt to problems raised from unforeseeable changes. For more complex forms of adaptation that require coordination among parties, relational governance is not adequate as it lacks coordinating capabilities. Contracts governance, however, has access to such capabilities through the specification of clauses and procedures that facilitate negotiations that invariably arise from BPR or technological changes. In short, although e-health absorptive capacity could be driven by both

![Figure 1. Research Model and Hypotheses.](image-url)
relational governance and contractual governance—given its sequential nature, we argue that relational governance at the early stage of e-health absorptive capacity will be more effectively enhanced by relational governance than contractual governance and at the later stage will be vice versa. The above theorizing collectively lead to the following:

H2: Healthcare-IT relational governance has a stronger impact on e-health entrepreneurial alertness than health technology contractual governance.

H3: Health technology contractual governance has a stronger impact on e-health assimilation than healthcare-IT relational governance.

H4: Health technology contractual governance has a stronger impact on e-health exploitation than healthcare-IT relational governance.

3 Research Methodology Iterative

3.1 Instrument development

We designed the initial questionnaire and subsequently refined it via several rounds of in-depth personal interviews with a panel of academic members and top management (e.g., superintendent, vice-superintendent, chief medical officer, and chief information officer) in the healthcare industry in Taiwan. Feedback from the in-depth personal interviews served as the basis for refining the experimental scales of the survey instrument before starting to gather large-scale survey data. Prior to mailing the questionnaires, an invitation letter was sent to members of the top management at the institutions. The letter explained the purpose of our study and inquired whether the organization would be willing to participate, with the institutional review boards (IRB) approval of their organizations. The questionnaire contained two major parts – (1) demographic and background information of the respondent and the healthcare organization and (2) the measurement items for the constructs. The basic data portion requested of members of top management in healthcare organizations to provide certain demographic characteristics (including job title and job tasks) in addition to the characteristics of their healthcare organizations. The second part contained the scale items relating to the five major constructs of the proposed conceptual framework. All measurement items of these five constructs were measured using a five point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

3.2 Data collection

Based on the annual statistics from the Department of Health Taiwan, we construct the initial mail-out list for distributing the questionnaires. The healthcare organizations included 20 medical centers, 72 regional hospitals and 21 qualified district hospitals. We endeavored to find a specific local contact person (i.e. secretary of superintendent) for each target healthcare organization. Overall, we sent out 823 questionnaires to all target healthcare organizations with copies being sent to multiple respondents at each organization with two or more branches located in different geographic areas of Taiwan. After allowing for a reasonable response period of four weeks, we conducted follow-up activities by email, telephone or mail, in order to increase the response rate and minimize the extent of non-response bias. Two hundred and thirteen questionnaires were returned. Thirty-one responses were incomplete and therefore discarded. This left 182 valid responses for the statistical analysis, resulting in a valid response rate of 22.11%. The potential for non-response bias was assessed by comparing the organization type, number of beds, and geographic location between early (e.g. first four-week period N=93) and late (e.g. last four-week period N=89) respondents. The results indicated that none of the chi-square values were statistically significant (p > 0.05, two-tail tests), suggesting that non-response bias was not a serious concern.
4 Results

4.1 Measurement Model Validation

All the constructs in the conceptual model were modeled as reflectively measured by multiple indicators. We assessed convergent and discriminant validity for all construct scales before the hypothesized relationships among the structural model was tested. Table 1 shows the descriptive statistics, composite reliability, Cronbach’s alpha, and average variance extracted (AVE) for all constructs in the research model. The values of Cronbach’s alpha and composite reliabilities were all higher than the recommended 0.7 (Nunnally 1978), and the values of AVE were all above 0.50 (Fornell and Larcker 1981), confirming internal consistency and convergent validity. The factor loadings of all scale items on their corresponding theoretical constructs exceeded the recommended 0.707 threshold in the PLS measurement model.

As can be seen in Table 2, discriminant validity was also supported because (1) all indicators load more strongly on their corresponding construct than on other constructs in the model; and (2) the square root of the average variance extracted (AVE) of each major construct was larger than the inter-construct correlations (Chin 1998). The above evidence suggests acceptable psychometric properties for all constructs in our research model.

<table>
<thead>
<tr>
<th>Construct</th>
<th>Scale item</th>
<th>Loading</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-health entrepreneurial alertness (eH_ALERT)</td>
<td>EEA1: Our hospital can be aware of the trends of e-health technology which affect care services.</td>
<td>0.79</td>
<td>4.08</td>
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<td></td>
<td>EEA2: Our hospital can grasp the requests for e-health regulation and policy from governments and third parties.</td>
<td>0.79</td>
<td>4.12</td>
</tr>
<tr>
<td></td>
<td>EEA3: Our hospital can identify new opportunities for e-health to reform healthcare procedures.</td>
<td>0.89</td>
<td>3.94</td>
</tr>
<tr>
<td></td>
<td>EEA4: Our hospital can acquire emerging technologies for e-health.</td>
<td>0.88</td>
<td>3.95</td>
</tr>
<tr>
<td>E-health assimilation (eH_ASSIM)</td>
<td>EA1: Our hospital can align clinical and care delivery system with e-health.</td>
<td>0.86</td>
<td>3.76</td>
</tr>
<tr>
<td></td>
<td>EA2: Our hospital can converge e-health with management competence to develop e-health services.</td>
<td>0.89</td>
<td>3.75</td>
</tr>
<tr>
<td></td>
<td>EA3: Our hospital can employ e-health to develop new care services.</td>
<td>0.87</td>
<td>3.65</td>
</tr>
<tr>
<td>E-health exploitation (eH_EXPLT)</td>
<td>EE1: Our hospital can use e-health innovatively to make profits in the long run.</td>
<td>0.93</td>
<td>3.63</td>
</tr>
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<td></td>
<td>EE2: Our hospital can reconfigure e-health resources to create innovative value.</td>
<td>0.90</td>
<td>3.53</td>
</tr>
<tr>
<td></td>
<td>EE3: Our hospital can implement appropriate e-health processes to the trends in the healthcare environment.</td>
<td>0.91</td>
<td>3.69</td>
</tr>
<tr>
<td>Healthcare-IT relational governance (eH_RELGOV)</td>
<td>RG1: Our hospital can build well-organized communication channels between healthcare and IT professionals.</td>
<td>0.84</td>
<td>3.93</td>
</tr>
<tr>
<td></td>
<td>RG2: Our hospital can facilitate healthcare professionals to realize the potential of IT.</td>
<td>0.82</td>
<td>3.89</td>
</tr>
<tr>
<td></td>
<td>RG3: Our hospital can motivate healthcare professionals and IT specialists to work together to ensure their satisfaction and ownership.</td>
<td>0.91</td>
<td>3.84</td>
</tr>
<tr>
<td></td>
<td>RG4: Our hospital can establish and maintain an IT department that is responsive to healthcare professionals’ requests/problems.</td>
<td>0.72</td>
<td>3.93</td>
</tr>
<tr>
<td></td>
<td>RG5: Our hospital can develop understanding, trust, and cooperation among healthcare professionals and IT specialists.</td>
<td>0.89</td>
<td>3.92</td>
</tr>
<tr>
<td>Healthcare technology contractual governance (eH_CONGOV)</td>
<td>CG1: Our hospital can proactively identify IT vendors who can provide potential values of new e-health technologies.</td>
<td>0.79</td>
<td>3.64</td>
</tr>
<tr>
<td></td>
<td>CG2: Our hospital can analyze how e-health activity could be successfully disaggregated and appropriately contracted.</td>
<td>0.87</td>
<td>3.61</td>
</tr>
<tr>
<td></td>
<td>CG3: Our hospital can ensure that healthcare technology contracts with external vendors remain within scope and budget.</td>
<td>0.81</td>
<td>3.66</td>
</tr>
<tr>
<td></td>
<td>CG4: Our hospital can monitor the healthcare technologies provided in the context of both the contractual requirements and the developing capability of the marketplace.</td>
<td>0.87</td>
<td>3.71</td>
</tr>
<tr>
<td></td>
<td>CG5: Our hospital can establish and manage a sourcing strategy of the healthcare technologies that meets the interests of the business.</td>
<td>0.87</td>
<td>3.58</td>
</tr>
</tbody>
</table>

Table 1. Descriptions and Confirmatory Factor Loadings of Scale Items
Table 2. Inter-correlation among Reflective Constructs. *Diagonal elements are the square roots of average variance extracted (AVE) of major constructs.

<table>
<thead>
<tr>
<th>Major Construct</th>
<th>Mean</th>
<th>S.D.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. eH_ALERT</td>
<td>4.02</td>
<td>0.67</td>
<td>0.84*</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2. eH_ASSIM</td>
<td>3.72</td>
<td>0.71</td>
<td>0.57</td>
<td>0.87</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. eH_EXPLT</td>
<td>3.62</td>
<td>0.80</td>
<td>0.57</td>
<td>0.69</td>
<td>0.91</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. eH_RELGOV</td>
<td>3.90</td>
<td>0.73</td>
<td>0.64</td>
<td>0.60</td>
<td>0.60</td>
<td>0.84</td>
<td></td>
</tr>
<tr>
<td>5. eH_CONGOV</td>
<td>3.64</td>
<td>0.74</td>
<td>0.49</td>
<td>0.63</td>
<td>0.62</td>
<td>0.62</td>
<td>0.84</td>
</tr>
<tr>
<td>Composite Reliability</td>
<td>0.90</td>
<td>0.85</td>
<td>0.90</td>
<td>0.89</td>
<td>0.90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cronbach’s Alpha</td>
<td>0.86</td>
<td>0.85</td>
<td>0.90</td>
<td>0.89</td>
<td>0.90</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4.2 Results of Causal Path Comparison and Structural Model Tests

The structural model of this study was also validated by the PLS technique. The bootstrapping analysis was used to generate 200 random samples of observations from the original data set by sampling through replacement. The path coefficients and explained variances are shown in Figure 2.

Figure 2. PLS Analysis Results of Research Model

To test the first set of tripartite hypotheses (H1a-H1c), which proposed that the effect of eH_ALERT on eH_EXPLT is mediated by eH_ASSIM, we followed the mediation tests suggested by Barron and Kenny (1986) and evaluate the mediation by computing the mean and standard deviation of the bootstrap samples from the previous PLS analysis. The analysis results showed that eH_ALERT had a positive and significant effect on eH_ASSIM ($\beta = 0.635$, t-value=9.459, $p<0.01$), supporting Hypothesis 1a. E-health assimilation had a positive and significant relationship with eH_EXPLT ($\beta = 0.636$, t-value=8.656, $p<0.01$), supporting Hypothesis 1b. Also, we observe a significant direct effect from eH_ALERT to eH_EXPLT ($\beta = 0.344$, t-value=4.253, $p<0.01$). We also performed the Sobel and Goodman tests to validate the mediation of eH_ASSIM on the causal effect from eH_ALERT to eH_EXPLT. However, to perform the Sobel and Goodman tests, the unstandardized path coefficients were required and the PLS results only provided standardized path coefficients. Thus, we perform multiple regression analyses (MRA) using SPSS software to obtain unstandardized path coefficients.

First, we used PLS to compute the unstandardized latent variable scores for all the theoretical constructs and then calculated the unstandardized path coefficients using MRA. We found both of the analytical results are significant (Sobel’s $z = 6.37$, $p<0.01$; Goodman’s $z = 6.35$, $p<0.01$), suggesting that the relationship between eH_ALERT and eH_EXPLT was mediated by eH_ASSIM, thereby supporting Hypothesis 1c. To further verify the mediation of eH_ASSIM on the causal effect of
eH_ALERT on eH_EXPLT given that the Sobel and Goodman tests have distributional assumptions, we evaluated the mediation effect using the bootstrap results. Specifically, we multiplied the two path coefficients for each bootstrap sample (i.e., b1: the coefficient between eH_ALERT and eH_ASSIM; and b2: the coefficient between eH_ASSIM and eH_EXPLT). We computed the mean value and the standard deviation of the cross-product term (b1 xb2), and divided the mean value by the standard deviation. We found the mediation of eH_ASSIM on eH_ALERT to eH_EXPLT is strongly significant (t-value = 4.39, p<0.01), thereby providing additional evidence in support of the theorized mediation effect.

We adopted the path comparison method proposed by Cohen et al. (2003) using the unstandardized path coefficients obtained from MRA to test H2, H3, and H4. As mentioned previously, we also followed the same procedures to calculate the unstandardized path coefficients using PLS results and multiple regression analysis (MRA). The results showed that: (1) eH_RELGOV had a stronger impact than eH_CONGOV on eH_ALERT and (2) eH_CONGOV had a stronger impact than eH_RELGOV on eH_ASSIM and eH_EXPLT. Therefore, H2, H3, and H4 were all supported. We also replicated using the PLS analysis results to further test the robustness of H2, H3, and H4 and found there is no significant difference.

As with all self-administered data, there is a potential for common method biases. We performed statistical analyses to assess the severity of common method bias. The Harmon one-factor test, the marker variable technique and the procedures recommended by Podsakoff et al. (2003) were conducted to verify the possible existence of common method bias. Collectively, the related analytical results show that common methods bias was not a serious validity threat.

5 Discussions and Conclusion

This study was motivated by the need for a theoretical explanation for how to exploit IT opportunities in a context (e.g., e-health) where IT is changing rapidly and the implementation context is complex with diverse stakeholders (e.g., IT, healthcare professionals, vendors and patients). Building on absorptive capacity theory from Cohen and Levinthal (1990) and concepts of IT governance, we developed three ideas. First, greater e-health entrepreneurial alertness enhances e-health exploitation in the e-health context by enhancing e-health assimilation. Second, relational governance has a stronger impact on the early stage (i.e., e-health entrepreneurial) of the absorptive capacity process than contractual governance. Third, contractual governance has a greater impact on the later stage of the absorptive capacity process (i.e., e-health assimilation and e-health exploitation) than relational governance. Our first contribution is a theoretical explanation for why e-health entrepreneurial alertness enhances e-health exploitation. Although prior studies have observed the association of entrepreneurial alertness on assimilation and how assimilation influences exploitation, the intervening mechanisms have largely been neglected in theory development.

Our results demonstrate that assimilation is an important intervening variable that mediates the influence of entrepreneurial alertness on the focal firm’s cost-effective and secure use of IT in support of health and health-related activities. This implies that for a hospital greater e-health entrepreneurial alertness increases e-health exploitation because it increases the focal hospital’s e-health assimilation. The results of our study imply that a focal hospital needs to develop the capability to identify and contract with IT vendors who can provide potential values of applying new e-health technologies, further to monitor and manage the project to ensure the success of assimilation and exploitation of the e-health. First, managers must recognize that increasing entrepreneurial alertness increases e-health exploitation of the focal hospital by making its e-health be comparable or can be transformed to its healthcare services and strategy. Thus, better entrepreneurial alertness is more aware of the trends of e-health technology, opportunity, and regular and policy from governments and third party, and this awareness provides greater motivation for focal hospital to acquire new e-health technologies which affect care services. However, they must also consider the costs of acquiring these new health technologies and weigh such benefits against the exploitation tradeoffs that entrepreneurial alertness
might have to make compared to more integral health services. Second, managers should recognize that in the early stage of absorptive capacity process, increasing relational governance is critical for IT and healthcare professionals to work together to identify the potential of e-health and match with economic opportunities. This is an important driving force for focal hospital to initiate the e-health project.

After the kickoff of the e-health project, managers should recognize that increasing contractual governance is critical for focal hospital to leverage external resources to lower the barriers of assimilation and exploitation of e-health, such as overcoming important technical hurdles and developing familiarity in using the implemented e-health to support their daily work. Such technical hurdles and familiarity should also reduce difficulties in employees’ ability to pursue innovative e-health use, making relational governance less influential for assimilation and exploitation processes than contractual governance. This study represents a significant advance in our theoretical understanding of the impact of relational and contractual governance on the absorptive process, and how to exploit IT opportunities in the e-health context.

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