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Summary: Hospitals in Taiwan are facing major changes and innovation is increasingly becoming a critical factor for remaining competitive. One determinant that can have a significant impact on innovation is hospital governance. However, there is limited prior research on the relationship between hospital governance and innovation. The purpose of this study is to propose a conceptual framework to hypothesize the relationship between governance mechanisms and innovation and to empirically test the hypotheses in hospital organizations. We examine the relationship between governance mechanisms and innovation using data on 102 hospitals in Taiwan from the Taiwan Joint Commission on Hospital Accreditation and Quality Improvement. We model governance mechanisms using board structure, information transparency and strategic decision-making processes. For our modeling and data analysis we use measurement and structural models. We find that in hospital governance, information transparency and strategic decision making did impact innovation. However, governance structure did not. To facilitate innovation, hospital boards can increase information transparency and improve the decision-making process when considering strategic investments in innovative initiatives. To remain competitive, hospital boards need to develop and monitor indices that measure hospital innovation to ensure ongoing progress.

Keyword: agency theory; governance mechanisms; hospital; innovation

INTRODUCTION

Hospitals around the world are facing unprecedented changes in many key areas, including technological advances, hospital-physician relationships, financing, and increasing competitive pressures. The changes are fueling concerns with regard to accessibility, quality of care, and cost containment.[1] Consequently, hospital executives are realizing innovation is necessary to improve their competitive position and organizational performance.[2] [3] As a result, hospitals are dedicating attention and resources to identify determinants that support innovation in hospital organizations.

Recently, 1 specific area under consideration is leadership and governance by board of directors that oversee innovation in hospitals. The social and economic contracts under which hospital boards operate are in the process of being transformed due to changes in health care delivery, organization, and financing.[4] These changes have impacted key areas that affect innovation, including maintaining harmonious relationships between physicians and managers, keeping up with competitive pressures, ensuring accountability to the communities, and responding to inspection of both clinical and administrative quality.[5] Moreover, the role of hospital governors in terms of both institutional and individual performance drives the focus of boards more toward the notion of public value (such as health quality innovativeness) rather than just compliance. The emergence of new theory for boards argue that effective board practices may lie in pursuing insights into the composition of boards, the focus of board

effort and board dynamics.[6] These 3 key elements may provide implications for hospital governance on its innovation as well. As a result, hospital boards are being challenged to simultaneously respond to and anticipate innovation. For example, the Institute for Healthcare Improvement launched the Boards on Board program in February 2007, which seeks to engage board leadership in innovation of clinical quality control.[7]

There is limited research on the relationship between governance mechanisms and innovation in hospitals. This study seeks to fill the current theoretical and empirical gap by asking the following research question: Do hospital governance mechanisms affect innovation in hospitals? We address this question in 2 ways. First, we propose a conceptual framework to hypothesize the relationship between hospital governance mechanisms and innovation. Second, we conduct an empirical study to test our hypotheses using data of 102 hospitals in Taiwan from the Taiwan Joint Commission on Hospital Accreditation and Quality Improvement (TJCHA).

THEORY AND HYPOTHESES

Separately, hospital governance and innovation receive considerable attention from both academics and practitioners. However, despite consensus about the importance of this board responsibility, there is limited research on the relationship between hospital governance with organizational innovation. Our study contributes to prior literature by developing conceptual model relating governance with innovation and empirically testing the model in the hospital industry.

We define hospital governance as overseeing the overall functioning and effective performance of the organization by setting the vision, mission, strategic plan, and goals and supporting and monitoring the execution of the plan and attainment of goals.[8] Chambers[6] also argues that high-performing boards across all sectors concentrate on shaping strategy, resource identification and use, and talent management. The governance function ensures that there is an adequate resource for the hospital to provide access and quality of care for the public.[7] Theoretically, the purpose of the governance function is to mitigate the principal-agent problem through information transparency, alignment of management incentives, and accountability.[9] The hospital governance literature provides a variety of mechanisms to resolve agency problems, including governance structure, information transparency, and decision making.[1] [8] [10] Ideally, the 3 mechanisms are used to put in place managerial checks so that the hospital operates according to its mission and strives to achieve its goals in an efficient and effective manner. Hospital goals include strategic investments in innovation for ongoing viability.

We define innovation as the organizational propensity to generate and adapt novel ideas or behavior through creation of new knowledge or unique application or combination of current knowledge.[2] Based on research by Teece,[11] we include the characteristics of innovation as appropriability, firm specificity, cumulativeness, and localization and continual effort toward uncertain outcomes. We further consider hospital innovation across 8 dimensions: strategy and community function, hospital management, patient rights and safety, systems and operations, health care processes, nursing care, pleasant environment, human resources, and quality control.

The recent work by O′Sullivan[12] provides a means to relate governance with innovation by conceptualizing innovation as a strategic investment. Using this perspective, our study focuses on the way governance mechanisms are used to allocate resources to strategic investments in innovation. We use 3 mechanisms to represent governance in our conceptual framework and empirical model: board structure, information transparency, and strategic decision making.

Governance structure and innovation

Governance structure is represented as the size of the board [10] and CEO duality.[13] Size is the number of directors on the board. Typically, hospital boards tend to be large due to the voluntary nature and the large number of different stakeholder interests they represent.[14] Historically, the major role of hospital trustees has been to maintain or enhance the legitimacy and prestige of the institution within the community as well as to attract resources to the hospital from the surrounding environment for innovation. Preference for board size is related to the resource dependence perspective [15] ; the greater the dependency on external sources, the larger the board of directors. However, prior research has found that larger size boards are not as conducive to innovation as smaller size boards because of limited focus and support for any 1 area of innovation.[14] In effect, smaller boards are more "manageable for innovation" from the CEO's perspective.[16] Therefore, smaller board size is seen as supportive of innovation, while larger size is not.

CEO duality is when an individual serves as both CEO and member of the board. In this dual role, the CEO has traditionally held more power vis-à-vis the board and the organization because of his or her ultimate authority over all aspects of the organization's operations.[13] Also, strong executive influence on the board is viewed as improving the linkage between policy making and operations, decreasing conflict between board members and management, and facilitating selection of directors whose views are consistent with the innovative philosophy of the organization. Furthermore, in order to preserve control and focus on innovation, the dual role of the CEO would reduce the risk of divided authority. Daily et al[13] find that by holding both of these powerful organizational positions there is greater assurance that both the board and/or management do not challenge or constrain innovative projects. According to the reasoning above, we develop the following hypotheses:

H1a: Smaller size of the hospital board is positively related to innovation.

H1b: Hospitals where the CEO has a dual role is positively related to innovation.

Information transparency and innovation

In complex organizations, such as hospitals, assessment of innovation is challenging partially attributed to information transparency. The lack of transparency was one of the most cited problems by the chairmen of the medical council with regard to assessing innovation.[8] Information transparency is classified in 3 ways: finance, health quality, and accounting and audit system. With regard to financial transparency, the board's responsibility is to set up planning and budgeting processes that monitor and report on the status of innovation programs.[17] In the process of innovation management, boards are required to conduct reviews to identify variances in financial performance and take corrective action if necessary. Thus, in order to support hospital innovation, financial measurement and transparency will provide more visibility to relevant stakeholders who have the influence and resources to further assist with adapting innovative programs.

With regard to quality, the hospital board's responsibility is to create a supportive and collaborative environment focused on continuous quality improvement.[18] More importantly, the board has legal accountability for ensuring the hospital meets acceptable standards of quality of care delineated in statutory law, regulatory requirements, and accreditation standards.[19] Freedman[20] states hospitals now have the obligation to report on quality of care whereas previously there had only been financial

accountability. Also, there is increasing public pressures to report on quality of care that is facilitating hospital innovation[21] by allowing for more exchange of information among different hospitals.

With regard to accounting and audit system transparency, the trend toward external oversight of hospitals' board structure and conduct has been increasing, particularly after the Sarbanes- Oxley Act was passed in 2002.[5] Although this act applies only to investor-owned corporations, it has influenced the board practices of various non-profit organizations. The IRS also has announced the development of its 2006 Exempt Organizations Implementing Guidelines, which demonstrate increasing attention to the behavior of non-profit hospitals.[5] Therefore, accounting and audit system transparency is mandatory to maintain legitimacy in order to acquire necessary resources to support innovation. Based on the reasoning above, we develop the following hypotheses:

H2a: Greater financial transparency is positively related to hospital innovation.

H2b: Greater health care quality transparency is positively related to innovation.

H2c: Greater accounting and audit transparency is positively related to innovation.

Decision-making mechanisms and innovation

A distinguishing characteristic of hospitals is that the locus of the decision making is diffuse due to multiple stakeholders.[22] As a result, it is imperative the board establish efficient decision making processes to manage innovation. The decision making processes must take into account the extent of board involvement, routine participation in meetings and clarity on the scope of authorization given to top management. Hospital board involvement in innovation projects is required to foster shared vision and values among employees of the organization.[23] Board involvement includes setting the expectation about the importance and direction of innovation initiatives.[18] This will both facilitate innovation adoption and increase employee commitment to innovation initiatives. Board involvement also allows the hospital to take advantage of external knowledge and resources to facilitate innovation.

With regard to routine participation in decision-making meetings, health care researchers have advocated the need for closer working relationships between hospital boards and top executives.[4] Traditionally, the hospital board's role is to “advise” or “monitor” the top management team. Recently, hospital boards have started routinely participating in strategic decision making in the area of innovation to remain competitive.[1]

With regard to decision-making authority, the responsibility of the hospital board is to clearly set and communicate the extent of CEO and management team's authority over resources dedicated to innovation.[8] After setting the extent of authority the board must oversee and monitor the CEO and management team's progress in innovation activities. More clarity and oversight provided by the board will facilitate and support hospital innovation. According to the reasoning above, we develop the following hypotheses:

H3a: More board involvement in hospital decision making is positively related to hospital innovation.

H3b: More routine participation in meetings by the board of directors is positively related to hospital innovation.

H3c: More clarity and oversight on the scope of authorization given top management by the board is positively related to innovation.

METHODS

Sample and data

We selected the hospital industry as our empirical setting to test the relationship between governance and innovation for 3 reasons. First, hospitals are under regulatory and competitive pressure to adopt innovations in clinical devices, equipment, surgery, pharmaceuticals, and treatment protocols requiring board involvement and approval. Second, specifically, hospitals in Taiwan are facing challenges in the area of cost containment and health care quality control pressuring hospital governance to turn to innovation for ongoing viability. Third, hospitals maintain detailed data on their activities.[24]

We examine the relationship between governance mechanisms and innovation of 102 hospitals in Taiwan—based on an archival database of hospital evaluation from TJCHA. This database includes the results of hospital evaluations from year 2007 to 2010. All 102 hospitals participating in this evaluation are included in this study. The category types of hospital in our sample include 93 general hospitals and 9 psychiatric hospitals. With regard to ownership structure, 75 hospitals are public and 27 are private.

Measurement

Independent variables

We use 3 exogenous latent variables based on the theoretical literature to assess hospital governance. They are governance structure, information transparency, and decision-making mechanisms. The first latent variable is governance structure (ξ1). According to Prybil[10] and Daily et al, [13] it is measured by 2 observed indices: the size of the board (x1) and the CEO duality (x2). The size of the board is measured by the number of board members. CEO duality is measured by dummy variables. If board director is also a CEO, we number it 1. Otherwise, it is zero. The second latent variable is information transparency (ξ2), according to Eeckloo et al,[8] it is measured by 3 observed indices: finance transparency (x3), health quality transparency (x4), and accounting and audit system transparency (x5). All 3 observed indices are measured by dummy variables. If finance or health quality information is available to the public, we number it 1. Otherwise, it is zero. If the hospital has a clear accounting and audit system, we number it 1. Otherwise, it is zero. The third latent variable is decision-making mechanisms (ξ3). According to Ford-Eickhoff et al,[1] it is measured by 3 observed indices: board involvement (x6), clear scope of authorization (x7), and routine participation in decision making (x8). All 3 observed indices are measured by dummy variables. If board of directors are involved in hospital activities, provide clear scope of authorization to top management, and routinely participate in decision making, we number it 1. Otherwise, it is zero.

Dependent variable

This study used 1 endogenous latent variable based on the theoretical literature to assess hospital innovation (η1).[2] Unlike manufacturing firms that can measure their innovation performance directly from patent, published journal articles, or R&D spending, the hospital industry has relatively few available measures of innovation.[25] Fortunately, using rating systems as heuristic devices to assess healthcare providers has become common worldwide.[26] Therefore, following the recent developments by Salge et al,[2] the indices in this study include both science and practice based innovation on the behavioral patterns of creating, implementing, and diffusing new knowledge observable in the hospital setting. This was accomplished by adopting archival data collected (y1) by TJCHA hospital evaluation database to measure hospital innovation. Hospitals that pass the evaluation requirements by TJCHA

obtain the following ratings: pass, fair, good, very good, and excellent. We classified these ratings of hospital evaluation into 5-point Likert scale ranging from pass (score 1), fair (score 2), good (score 3), very good (score 4), and excellent (score 5) to represent the extent of innovation. The higher score of hospital evaluation means the higher innovation.

Control variables

Hospital type and ownership are used as control variables. They are measured as dummy variables. For ownership, all sample hospitals were divided into either (1) public-oriented or (2) private-oriented hospital. For hospital type, all sample hospitals were divided into either (1) general or (2) psychiatric hospital. These measures are also collected from the TJCHA database.

FINDINGS

To translate our conceptual framework into an empirical model, we developed a measurement and a structural model for our data analysis. Specifically, we used the partial least squares, PLS-Graph version (3.0), which provides the analysis of both a measurement model and a structural model. We selected PLS because it places minimal restrictions on measurement scales, sample size, and residual distribution.[27] It allows latent constructs to be modeled as formative or reflective indicators, as required by our model with a formative second-order construct.

Measurement model

The adequacy of the measurement model was evaluated on the criteria of reliability, convergent validity, and discriminant validity. Reliability was examined using the composite reliability values, which should be greater than the benchmark of 0.5 to be considered adequate.[27] Table indicates that all the values are above 0.5, indicating adequate reliability. In construct validation, both convergent and discriminating validity are analyzed. Convergent validity is measured by average variance extracted (AVE) for each construct during the reliability analysis that should be 0.5 or better.[28] Table shows the AVE for the constructs ranged from 0.79 to 0.87, indicating a sufficient level of convergent validity of all constructs. To further verify discriminate validity, Fornell et al [28] advocate that correlations between items in any 2 constructs should be lower than the square root of the AVE shared by items within a construct. As shown in Table 1, the square root of the AVE shared between a construct and its items was greater than the correlations between the construct and any other construct in the model, satisfying the Fornell et al [28] criteria for discriminate validity. The above results, therefore, confirm that our model encompassed satisfactory construct validity.

TABLE 1 Reliability and validity

Constructs	Items	Composite reliability (CR)	AVE
Category and ownership	2	NA[a]	NA[a]
Governance structure	2	0.8695	0.7696
Information transparence	3	0.6083	0.4559
Decision mechanisms	3	0.7873	0.6190
Innovativeness	1	1[b]	1[b]

Note:

[a]Formative construct; there are no CR and AVE.

[b]Single indicator; its error variance is zero. Therefore, CR and AVE both equal to 1.

$$CR(\xi) = \frac{(\sum_{i=1}^{n}\lambda_i)^2 Var(\xi)}{(\sum_{i=1}^{n}\lambda_i)^2 Var(\xi) + \sum_{i=1}^{n} Var(\delta_i)}, \quad AVE(\xi) = \frac{\sum_{i=1}^{n}\lambda_i^2 \cdot Var(\xi)}{\sum_{i=1}^{n}\lambda_i^2 \cdot Var(\xi) + \sum_{i=1}^{n} Var(\delta_i)}$$

TABLE 2 Correlations and the square root of AVE among the factors of the measurement model among constructs

Constructs	GS	ID	DM	EE
Governance structure (GS)	**0.8772**			
Information transparence (IT)	−0.6974	**0.6752**		
Decision mechanisms (DM)	−0.1989	0.2944	**0.7876**	
Innovativeness (I)	−0.3656	0.4306	0.3164	**1**

The number on diagonal line is the square root of the AVE of each variable. The numbers below diagonal line are correlation coefficients.

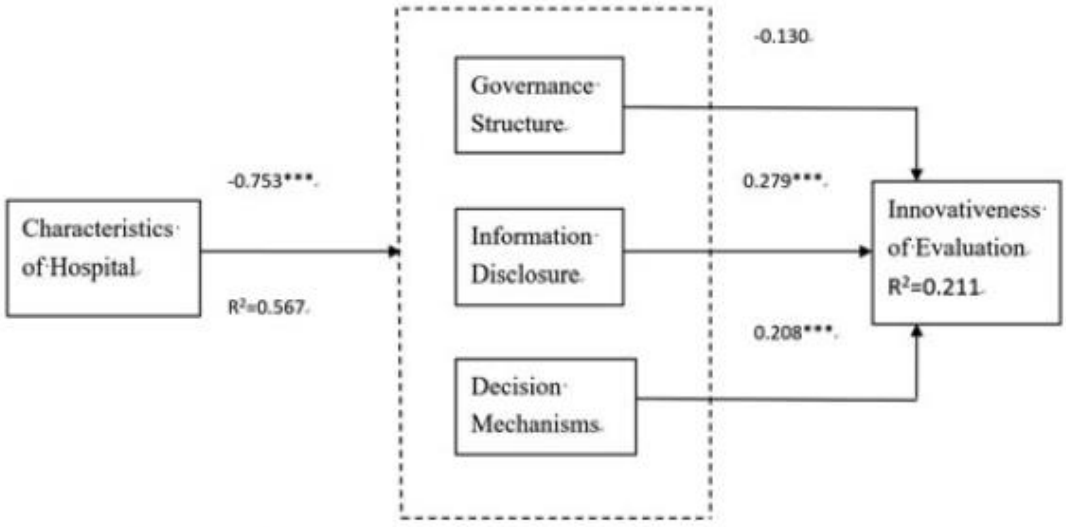

FIGURE 1 Analysis of the conceptual framework

Structural model

In PLS analysis, examining the structural paths and the R2 scores of endogenous variables assesses the explanatory power and fit of a structural model. The results of structural path analysis are depicted in Figure 1. The model accounts for 21%–56% of the variance (R2 scores). Overall, the research model accounted for 21% of the variance of repeat efficiency of evaluation, as shown in Figure 1. Thus, the fit of the overall model is good.

The pattern of direct effects revealed by the path model seems to provide somewhat mixed evidence for the study's hypotheses. According to Hypotheses 1a and 1b, this study expected a positive relationship between governance structure and hospital innovation. However, the path model reveals no significant correlations between governance structure and hospital innovation ($t = 1.529$, $p > 0.1$). This factor likewise failed to demonstrate significant correlations in the model. Therefore, Hypotheses 1a and 1b are not supported.

According to Hypotheses 2a, 2b, and 2c, a positive relationship was expected between information transparency and innovation. The result of the path model supported these hypotheses. There was a positive direct effect of information transparency on hospital innovation ($t = 3.531$, $p < 0.01$). Hypothesis 3a, 3b, and 3c proposed that there is a positive effect of decision-making mechanisms on hospital innovation. The path model showed a positive effect of decision-making mechanisms on hospital innovativeness ($t = 3.458$, $p < 0.01$). Thus, the results of the path model support these hypotheses.

DISCUSSION

The aim of this study is to propose a conceptual framework to represent hospital governance and empirically examine its effect on hospital innovation. We represent hospital governance as comprised of governance structure, information transparency, and decision-making mechanisms. Our findings suggest that certain hospital governance mechanisms, information transparency and decision-making mechanisms, influence hospital innovation. However, governance structure has no such effect. This result suggests that the structure per se may not be a critical factor for promoting hospital innovation. Regarding the insignificance of size of board, we suggest that balancing size with inclusivity may have better impact on its innovation than size only. In the UK NHS, for example, governance boards incorporate both nonexecutive directors and community governance. The diversity of board member may stimulate novel idea for further innovation.[29] Regarding the insignificance of CEO duality, we believe the other side of the argument that a rather insulated “view of the world” of the CEO also fulfills the role of governance chair may lead to dysfunctional hospital governance that further impact hospital innovation. In sum, the results are generally consistent with agency theory,[30] which states that institutional arrangements of hospital governance have comparative advantages in solving the agency problems, thereby enhancing the hospital's propensity for innovation.

The contribution of this article is that we use agency theory to conceptualize the relationship between hospital governance and innovation for hospital organizations. Currently, there is limited research on governance mechanisms and innovation in hospitals. Therefore, more generally this study contributes to the field of health care management by demonstrating the impact governance mechanisms can have on innovation. Moreover, from a methods perspective, this study provides specific indices to measure innovation, governance mechanisms, and an empirical model for future research in this area.

Our findings demonstrate that hospital governance mechanisms can have a positive effect on innovation. This information can be useful to hospital boards and executive management who are interested in facilitating innovation in their organizations. Specifically, in order to increase innovation, hospital boards can provide greater information transparency to the public in the areas of finance, health care quality, and accounting and audit systems. Also, hospital boards can enhance the decision making processes in the area of innovation to include more board member involvement, set clear authorization scope for executive management, and more routinely participate in strategic decision making to support innovative initiatives. Finally, hospital boards need to consider developing a variety of indices measuring hospital innovation in the science and practice areas for reporting and monitoring ongoing progress.

There are several limitations in this study. First, we measure hospital innovation using 1 specific rating scale over a fixed time period. This measure may not capture all aspects of innovation that can be influenced by board governance. We recommend a greater variety of innovation measures are included in future studies. Second, our data are from the hospital industry in Taiwan, thereby limiting our generalizability in 2 key areas. First, our sample data are from Taiwan and hospital governance in other countries could be operating differently. Second, our results are in the hospital industry and may not apply to other health care provider organization such as nursing homes, rehabilitation centers, and skilled nursing facilities. Future studies can explore the use of our measures and model in other countries and types of health care provider organizations. Our expectation is that future studies will further develop and test our conceptual constructs that will lead to the development of a more robust and informative model that will allow the governance function to facilitate innovation in healthcare management.

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HUMAN ETHICS GUIDELINE CONFIRMATION

The authors confirm compliance with human ethics guideline of National Cheng Kung University Human Research Ethic Committee in April 6, 2014.

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