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Competition and Cooperation of Hospitals: The Effects of Environment, Resource and Strategy on Performance

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Abstract

This empirical study aims at examining how environmental uncertainty, resources, and competitive and cooperative strategies affect hospital performance. Hospital resources are measured by numbers of hospital beds, equipment and facilities, and specialist physicians. Ten items are used to measure competitive strategy, such as providing higher-quality and non-BNHI services, recruiting well-known doctors, emphasizing medical innovation, marketing, and cost-control. Another ten items are used to measure cooperative strategy as well, such as forming medical and non-medical alliances, participating in healthcare and medical associations, interacting with government authorities, and patient referral. The environmental uncertainties are measured by four items including regulatory changes from healthcare authorities, unpredictability of healthcare regulations and policies, environmental impacts from healthcare policies and from the Global Budget system. Hospital performance is measured by the number of inpatient admissions per doctor, infection rate, and occupancy rate. The researchers collected data by distributing questionnaires in 509 hospitals. Of these, 130 hospitals responded, demonstrating a valid response rate of 25.54%. Factor analysis and regression analysis were used to test the hypotheses. The empirical results show that (1) The more the hospital beds, the higher the number of inpatient admissions per doctor and occupancy rate; (2) Cost-control strategy leads to a higher number of inpatient admissions per doctor; and (3) Cooperating with government and associations results in better performance; (4) Environmental state uncertainty reinforces the positive correlation between innovation strategy and performance; whereas cost-control strategy leads to a higher infection rate; (5) Environmental uncertainty reinforces the positive correlation between cooperative strategy and performance. This study contributes to further exploration of insights into research issues in competitive and cooperative strategies. According to our empirical results, we propose several suggestions for healthcare practitioners to use to formulate and implement their strategies to create better performance.

Key words: Resources, Competitive strategy, Cooperative strategy, Environmental uncertainty, Hospital performance.

1. Introduction

The implementation of global budget in the national healthcare insurance system has increased the pressure on hospitals' operation and survival. Highly visible injury incidents raise the medical responsibility risk (Yang, 2003). The hospitals which used to have an elevated image have now been forced to face operational predicaments and environmental uncertainty. Previous research on healthcare management and strategy were emphasized on the impact of external environments (such as health insurance policy), and less attention has been paid to examining the relationship between competitive advantage and hospital performance from an internal aspect (Barney, 1991; Collis, 1991). Therefore, the first purpose of this study is to examine the effects of hospital resources on performance.

In view of living in environmental uncertainty, many hospitals adopt the competition strategy, such as investment of high-tech medical devices and the innovation of medical technology and healthcare services, to maintain or increase the healthcare market share (Wang,

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Yeh, & Chern, 1999). On the other hand, hospitals also adopt a cooperation strategy, such as joint operation or alliances, to survive in the healthcare market (Ahuja, 2000; Provan & Sebastian, 1998). Therefore, the second purpose of this study is to examine how competition and cooperation strategies affect hospital performance.

Zajac, Kraatz, and Bresser (2000) proposed an integrated dynamic framework to examine the effects of environment, strategy, and organizational contingencies (such as resources and capabilities) on performance. They state that although the concept of "fit" had been widely perceived by scholars, the related empirical studies were limited. After the insurance organizations got involved in the healthcare industry, the relationships between and among actors in the healthcare market have become more complex. Therefore, the third purpose of this study is to examine how hospitals create better performance through the fit among environment, resources and strategies under current environmental uncertainty.

2. Theoretical Backgrounds and Hypotheses

2.1 Correlation between Hospital Resources and Performance

Resources include all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc. controlled by a company that enables that firm to conceive of and implement strategies that improve its efficiency and effectiveness (Barney, 1991). Some resource characteristics—imperfect mobility, imperfect imitability, and imperfect substitutability—prevent companies from moving towards resource homogeneity (Barney, 1991; Chi, 1994; Das & Teng, 2000; Dierickx & Cool, 1989; Peteraf, 1993).

The healthcare sector is composed of more actors and stakeholders, which leads to the importance of understanding the source of healthcare performance. The positive effect of firm-based resources on performance has been acknowledged (Zaheer & Bell, 2005). Since many resources are firm-specific and not perfectly mobile or imitable, firms are continuously heterogeneous in terms of their resource bases. Sustained firm resource heterogeneity becomes a possible source of competitive advantage (Grant, 1991; Reed & De Fillippi, 1990), which then leads to economic rents, or above-normal returns (Das & Teng, 2000). In the healthcare industry, hospital-specific resources include tangible resources, such as medical facilities and equipment, and intangible resources, such as professional technique, ability, and public reputation, etc. Douglas and Ryman (2003) suggest that the acquisition and deployment of a set of valuable and distinctive competencies, as represented by the medical services offered, would enable a hospital to establish a favorable reputation in the market, thereby attracting more patients. They investigated the association between strategic resources and performance for 824 general hospitals in the U.S.A., confirming the positive correlation between strategic resources and the financial performance of hospitals (measured by cash flow margin). In addition, Peng, Lo, Lin and Yu (2006) investigated 98 hospitals in Taiwan and found that hospital resource is positively related to performance as measured by fifteen indicators such as profits, revenues, cost control, medical quality, the number of outpatient visits, the number of inpatient admissions, occupancy rate, and patient satisfaction. Therefore, the more abundant the hospital resources, the more complete the healthcare services that hospitals can provide to generate better performance. We thus propose the following - Hypothesis 1.

Hypothesis 1: Hospital resource is positively associated with hospital performance.

2.2 Correlation between Competition Strategy and Performance

Cleverley and Harvey (1992) investigated the correlation between competitive strategy and performance for 1,025 metropolitan hospitals in the U.S.A., finding that different strategies affect a hospital's financial performance (measured by return on investment, ROI). In particular, they found a significant effect between cost-control strategy and ROI. Marlin, Huonker, and Sun (2002) demonstrate that hospitals perform better when they simultaneously adopt cost-leadership and differentiation strategies. Similarly, Douglas and Ryman (2003) support the positive correlation between competitive strategy and hospital's cash flow. Therefore, Hypothesis 2 is proposed accordingly.

Hypothesis 2: Competition strategy is positively associated with hospital performance.

2.3 Correlation between Cooperation Strategy and Performance

Cooperative strategy such as joining alliances and networks has led to long-term performance consequences

for the firm (Gulati, 1999). In the healthcare industry, as well as competitive strategy, cooperative strategy is adopted by hospitals to reduce cost, to improve effectiveness, and to recruit physicians and attract patients (Lindrooth, Lo Sasso, & Bazzoli, 2003). The economy of scale created by cooperative strategy has become one of the competitive advantages of organizations (Ketchen, Palmer, & Gamm, 2001). Zuckerman, Kaluzny, and Ricketts (1995) indicate the advantage of joining healthcare strategic alliances. They illustrate how newly-formed group practice takes advantage of the larger scope of services that can be offered, along with the cost efficiencies and sharing of administrative burdens. Shortell, Gillies, Anderson, Erickson, and Mitchell (2000) claim that through inter-organizational linkages, both the physician groups and hospitals are able to combine complementary resources and offer an efficient and differentiated continuum of care. They indicate that integrated healthcare systems experienced higher total revenues and cash flows. Walsh and Szabat (2002) state that hospitals' participation in inter-organizational cooperation with healthcare-related associations, governmental agencies, and other organizations can enhance hospitals to accumulate their social capitals, which then in turn create better performance such as expand market share, increase profitability, access to capital, expand managed care contracts, enhance reputation of staff, expand products or services, diversify organizational portfolio, and provide economies of scale. In addition, according to the logic of relational view, Douglas and Ryman (2003) suggest that the linkages between hospitals and physicians provide both parties with the opportunity to combine the resources needed to establish advantageous competitive positions. In Taiwan, the inter-hospital collaborative arrangements, such as patient referral and family doctor integrated care projects, have emphasized the complementary resources between and amongst hospitals, which then results in better services. Accordingly, we propose the following - Hypothesis 3.

Hypothesis 3: Cooperation strategy is positively associated with hospital performance.

2.4 The Effect of Environmental state Uncertainty on the Relationships between Resources, Strategy and Performance

According to Milliken (1987), Begun and Kaissi (2004) the perceived environmental uncertainty (PEU) can be classified into three types: state uncertainty, effect uncertainty, and response uncertainty. The state uncertainty means that the managers lack information about the predictability of the environment. The effect uncertainty means that the managers are unable to predict what the nature of the impact of a future state of the environment or environmental change will be on the organization. The response uncertainty means that the managers perceive a lack of information about what the organization's response options are and/or about the utility of each course of action. In accordance with Farjoun (2002), the industry structure model and SCP (Structure-Conduct-Performance) paradigm (Bain, 1956) views the external environment as a key determinant of strategy and performance. Farjoun argues that a company should continuously co-align its strategy with its external environment by building on and modifying its internal attributes and forces to respond to, and influence, environmental conditions and development. Parthasarthy and Sethi (1992) present a framework by linking a firm's technology, business strategy, and their influence on performance within the constraints posed by the industry's technological environment and the general socioeconomic environment. Short, Palmer, and Ketchen (2002) pointed out that historically, most hospitals were reimbursed the full cost of patient care from third party payers. In Taiwan, hospitals have to not only cope with the high level of control from government, but also face the monopolistic power from the Bureau of National Health Insurance (BNHI). Thus, the environmental uncertainty may have moderating effects on the relationships among resource, competition and cooperation strategies, and hospital performance.

Firstly, environmental uncertainty moderates the correlation between resource and performance. In the healthcare setting, Begun and Kaissi (2004) indicate that when environments are perceived as uncertain, greater amounts of time and resources are spent on environmental scanning and forecasting, at least until scanning and forecasting are viewed as futile. Short et al. (2002) investigated 85 hospitals in the U.S.A. and found that when the environment is highly competitive, the more resources in the form of hospital beds and healthcare delivery are provided, and the better the hospital performance as measured by the return on assets, average occupancy, and admissions per bed. In Taiwan, the

implementation of a global budget program has elevated the environmental uncertainty. Intensive competition and the dramatic regulatory change have forced hospitals to invest in more resources and strengthen their advantages for value creation. Accordingly, we propose the following Hypothesis 4.

Hypothesis 4: The perceived environmental uncertainty will moderate the correlation between resource and hospital performance.

Secondly, environmental uncertainty moderates the correlation between competition strategy and performance. Short et al. (2002) found that hospitals in the U.S.A. developed innovative services and delivered more efficient healthcare services when they perceived more and more limited insurance payment and decreased healthcare revenues. In Taiwan, hospitals adopted differentiation, innovation, and diversification strategies when they perceived high environmental uncertainty. Under the dramatic external change, hospitals adopted competition strategies by innovative services and improving efficiency in order to deliver better quality services and create financial outcomes. Hypothesis 5 is proposed accordingly.

Hypothesis 5: The perceived environmental uncertainty will moderate the correlation between competition strategy and hospital performance.

Thirdly, environmental uncertainty moderates the correlation between cooperative strategy and performance. Sinay and Campbell (2002) investigated the merge strategy of 129 hospitals in the U.S.A. They compared the performance (as measured by average annual expenses, average supply costs, full-time equivalent employees / bed, inpatient days / full-time equivalent employees, outpatient visits / full-time equivalent employees, and occupancy rates) before and after the merge, finding that cooperation strategy ensures hospitals' survival, when hospitals perceived that the healthcare insurance payment is reduced and the competition in the local healthcare market is intensive. Forming strategic alliances, firms are able to obtain necessary resources and to quickly respond to environmental changes (Gulati, 1998) especially when the environmental uncertainty is higher, and more cooperation is required (Walsh & Szabat, 2002). In Taiwan, forming healthcare alliances and networks is proliferating, more and more hospitals adopt a cooperative strategy to enhance their competitive advantage and strengthen their positions in the niche market (Peng et al., 2006). We therefore propose Hypothesis 6.

Hypothesis 6: The perceived environmental uncertainty will moderate the correlation between cooperation strategy and hospital performance.

In summary, based on both theoretical review and healthcare practices, this study proposes six hypotheses to examine how internal resources and strategy affect performance, and how external environmental uncertainty moderates the relationships among resource, strategy, and performance. The above six hypotheses are delineated in Figure 1, in which Hypothesis 1 addresses the main effect of resource on performance; Hypotheses 2 and 3 demonstrate the main effect of strategies on performance; Hypothesis 4 shows the moderating effect of environmental uncertainty on the correlation between resource and performance; and Hypotheses 5 and 6 address the moderating effect of environmental uncertainty on the relationship between strategies and performance.

The strategic fit paradigm asserts the necessity of maintaining a close and consistent link between a firm's strategy and the context within which it is implemented (Venkatraman, 1989). Farjoun (2002) proposes an integrative theoretical model of Organization – Environment – Strategy – Performance (OESP) to incorporate both external consistency and internal consistency. Internally, strategy coordinates goals and means, internal resources and administrative infrastructure. Externally, a firm's coordinated goals and actions are anchored in its continuous co-alignment with its environment. Both internal fit and external fit have significant effects on performance (Katsikeas, Samiee, & Theodosiou, 2006; Venkatraman & Prescott, 1990; Zajac et al., 2000). Therefore, we argue that hospitals perform well not only by possession of resource advantages and adoption of proper strategies internally, but also by adaptation and adjustment with environmental changes externally. That is, from an integrated perspective, internal fit between resource and strategy and external fit between strategy and environment are both important for generating hospital performance.

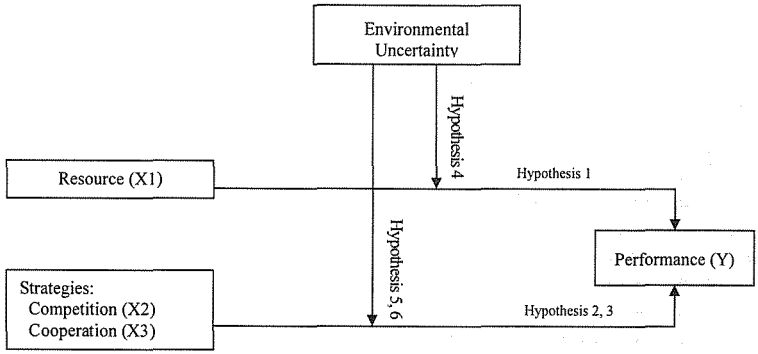

Figure 1. Conceptual framework

3. Methodology

3.1 Data Collection

The data on resource and performance were collected by secondary data from the Department of Health, Executive Yuan in 2002, whereas the data on competition strategy, cooperation strategy, and environmental uncertainty were collected by survey. The questionnaire was developed based on theoretical review and healthcare practice. All items in the questionnaire were on a seven-point Likert-scale ranging from 1 (strongly disagree) to 7 (strongly agree).

We collected the main study data by survey. The structured questionnaire was mailed to the whole healthcare population in Taiwan in 2003. In total, 509 hospitals contracted with the BNHI were investigated. 160 hospitals responded to the survey, of which 130 were valid responses but 30 remaining samples were excluded due to incomplete information, showing a valid response rate of 25.54%. The 130 valid samples were composed of 12 medical centers (57.17%), 33 regional hospitals (41.77%), and 85 district hospitals (20.88%). Further examination of the sample composition by hospital accreditation level and hospital beds revealed that the sample comprised at least half of the large-scale hospitals included in this study. The small-scale hospitals were less represented in our sample. We then used the geographical location as a variable to compare the difference between population and collected samples, yielding no significant differences between population and valid samples at each different geographical location.

3.2 Measurements

The constructs in this study are derived from both theoretical perspectives and practices. We developed the instrument by the following procedure. We first identified a preliminary scale based on relevant literatures. Then we consulted with 14 experts from both academia and the healthcare industry (CEOs and top managers) to refine the preliminary questionnaire and improve content validity.

Resource. Hospital resources can be simply denoted by human resources and hospital beds (Han, 1990). In this study, according to the 2004 Hospital Accreditation List, hospital resources are measured by three items: number of hospital beds, equipment and facilities, and number of specialist physicians. The hospital beds include acute beds, chronic beds, special beds, and observation beds registered in 2002. The equipment and facilities were measured by the registered number of Computered Tomography (CT).

Strategies. In accordance with the viewpoints of Shortell and Zajac (1990), Lado, Boyd, and Hanlon, (1997), Ketchen et al. (2001), and Walsh and Szabat (2002), we classified strategy into competition strategy and cooperation strategy. *Competition strategy* is defined as hospitals adopting innovation, differentiation, and cost leadership strategies to attain organizational goals (Chen, 1996; Ketchen et al., 2001; Mehra, 1996; Young, Parker, & Charns, 2001). Ten items are used to measure competition strategy, including: (1) compared to its competing hospital, this hospital offers more unique and high-quality healthcare services; (2) this hospital provides more non-NHI and more diversified services (such as maternity center, weight-control center, or physical

examination center); (3) this hospital invests more in high-tech and advanced equipment and facilities; (4) this hospital exploits new medical technologies and services; (5) this hospital places more emphasis on operational process improvement; (6) this hospital places more emphasis on promotion in the healthcare market; (7) this hospital provides more differentiated services (such as free registration, car parking services, weekend and evening services); (8) this hospital focuses more on personnel cost control; (9) this hospital focuses more on non-personnel cost control; (10) this hospital recruits more well-known doctors. *Cooperation strategy* is defined as hospitals exchanging resources and information by collaborating with other organizations (Succi-Lopez, Lee, & Alexander, 2003; Walsh & Szabat, 2002; Zajac et al., 2000). We measure cooperation strategy by the following 10 items: (1) hospital is assertively involved in medical-specialist associations; (2) hospital forcefully forms strategic alliances with its non-medical partners; (3) hospital plays an assertive role in healthcare-related associations; (4) hospital plays an uncompromising role in healthcare academic associations; (5) staff of the hospital occupy significant positions in medical-specialist associations; (6) hospital intensively interacts with governmental authorities (such as the Department of Health, Executive Yuan, the BNHI, and local healthcare government); (7) hospital initiates more inter-hospital cooperative arrangements (such as the sharing of physicians and joint training); (8) hospital initiates more facility-sharing arrangements (such as sharing operation rooms); (9) hospital forms a referral network with clinics and other hospitals; (10) hospital forcefully participates in an *integrated healthcare service delivery program* launched by Central Government.

Environmental uncertainty. In accordance with the perspectives of Kumar, Subramanian, and Strandholm (2002) and Begun and Kaissi (2004), environment may incorporate task environment and perceived environment. In this study, we measure the perceived environmental uncertainty by four items: (1) The healthcare authorities (such as the Department of Health, Executive Yuan, the BNHI, and local healthcare government) has been frequently changing the healthcare regulations and policies. (2) The regulations and policies made by the healthcare authorities are unpredictable. (3) The regulations and policies made by the healthcare authorities have great impact on hospitals' operation and management. (4) The Global Budget launched by the BNHI has great impact on hospitals' operation and survival.

Performance. Measuring the healthcare performance has become an essential but challenging task for hospitals. The degree to which key stakeholders actively monitor and challenge management appears to provide an important constraint on healthcare managers' description of performance outcomes (Ketchen et al., 2001). In this study, according to the performance indicators listed on the 2004 Hospital Accreditation List, we consulted 14 experts to select the most important performance measurements in the healthcare industry. The 14 experts incorporated experts both in the academia and in the industry including CEOs and top managers from medical centers, regional hospitals, and district hospitals. Eventually, 3 out of 17 items were selected as the most important performance indicators. They are: the number of inpatient admissions per doctor, infection rate, and occupancy rate. We did not use financial data as a performance indicator due to the following constraints. Firstly, the measure of profitability is not standardized among hospitals, which leads to the difficulty in analyzing and comparing hospitals' profitability (Vogel, Langland-Orban, & Gapenski, 1993). Secondly, unlike the healthcare industry in the U.S., the Taiwan healthcare industry is characterized as non-profit making in that financial performance measurements such as ROI may not be appropriate for application to all the hospitals in Taiwan. Thirdly, the secondary data we collected from the Department of Health did not reveal financial indicators. In addition, as confidentiality is a major concern, we did not collect financial performance from hospitals.

3.3 Validity, Reliability and Factor Analysis

The constructs in this study are derived from both theoretical perspectives and practices. We developed the instrument by the following procedure. We first identified a preliminary scale based on relevant literatures. Then we consulted with 14 experts from both academia and the healthcare industry (CEOs and top managers) to refine the preliminary questionnaire and improve scale validity. On the other hand, we also tested the reliability. Table 1 shows the results of reliability test, in which the reliability is acceptable, given that the Cronbach's α of three constructs (competitive strategy, cooperative strategy, and environmental uncertainty) all reach above 0.5, as Churchill (1979) indicated that it is acceptable when Cronbach's α is above 0.5, and high when Cronbach's α is

above 0.7

According to the results of factor analysis, competition strategy can be classified into two factors. Factor 1 includes adoption of advanced medical technology and initiation of differentiated and innovative healthcare services, investment in innovative equipment and facilities, and diversification. The researchers therefore identified factor 1 as the "service innovation competition strategy". Factor 2 includes adoption of effective labor and non-labor cost control; therefore factor 2 was identified as the "cost-control competition strategy". Cronbach's α (0.874 and 0.699) and communality estimates for all items found that this factor analysis (0.866-0.518) confirmed the internal consistency of this construct and the appropriateness of each question underlying this construct, respectively.

Cooperation strategy can also be classified into two factors. Factor 1 includes cooperation with government agencies, healthcare associations, and medical specialist academies. Thus, factor 1 is identified as the "governmental cooperation strategy". Factor 2 includes cooperation with other hospitals or organizations in the upstream and downstream areas. Thus, it is identified as the "industrial cooperation strategy". Cronbach's α (0.874 and 0.737) and communality estimates for all items found from our factor analysis (0.900-0.473), confirmed the internal consistency of this construct and the appropriateness of each question underlying this construct, respectively.

Moreover, environmental uncertainty can also be classified into two factors. Factor 1 includes the regulations and policies made by the healthcare authorities which have been changing frequently and are unpredictable. We therefore identified factor 1 as the "environmental state uncertainty".

Factor 2 includes the impact from the regulations and policies made by the healthcare authorities and the impact from the Global Budget launched by the BNHI. Thus,

Table 1. Results of factor analysis and reliability test

Concept	Item	Factor loading		Eigen value and Variance account for (%)		Cronbach's α	
		Factor 1	Factor 2	Factor 1	Factor 2	Factor 1	Factor 2
Resources	Physicians	0.603		2.338			
	Hosp beds	0.561		(77.94%)			
	Equipments	0.566					
Competition	2-3	**0.830**	0.119	4.946	1.266	0.874	0.699
	2-4	**0.816**	0.194	(49.46%)	(12.66%)		
	2-1	**0.778**	0.205				
	2-2	**0.737**	0.118				
	2-5	**0.709**	0.344				
	2-6	**0.608**	0.406				
	2-10	**0.534**	0.444				
	2-8	0.080	**0.866**				
	2-9	0.202	**0.862**				
	2-7	0.392	**0.518**				
Cooperation	2-14	**0.900**	0.085	4.780	1.353	0.874	0.737
	2-13	**0.879**	0.171	(47.8%)	(13.53%)		
	2-15	**0.830**	0.252				
	2-16	**0.692**	0.445				
	2-20	**0.583**	0.319				
	2-18	0.181	**0.791**				
	2-17	0.279	**0.755**				
	2-11	0.028	**0.739**				
	2-19	0.404	**0.562**				
	2-12	0.296	**0.473**				
Environment	1-2	**0.874**	0.066	1.792	1.044	0.603	0.527
	1-1	**0.814**	0.130	(44.79%)	(26.1%)		
	1-4	-0.058	**0.890**				
	1-3	0.352	**0.717**				

factor 2 is identified as the "environmental impact uncertainty". Cronbach's α (0.603 and 0.527) and communality estimates for all items found from our factor analysis (0.874 -0.717), confirmed the internal consistency of this construct and the appropriateness of each question underlying this construct, respectively.

4. Result and Discussion

In this research, we use regression analysis to test our hypothesis. Hypotheses 1 to 3 were proposed to appreciate how resource, competitive strategy, and cooperative strategy have effects on performance. Table 2 shows the results of regression analysis. Three performance indicators (infection rate, the number of inpatient admissions per doctor, and occupancy rate) were used as dependent variables. We ran two models for each independent variable: Model 1 is the base model which includes only control variables; Model 2 tests the main effects of variables, including resources, innovation competition, cost-control competition, governmental cooperation, and industrial cooperation. Table 3 shows the moderating effects of environmental uncertainty upon the correlations among resource, strategy and performance. The VIF-value of each regression model is less than 10, which is between 1.24 and 5.95: these models ruled out a multi-collinearity problem. The major findings and discussion are shown as follows.

4.1 Correlation between Resources and Performance

Hypothesis 1 proposed that hospital resource is positively associated with hospital performance. In Table 2, the results of the main effects in model 2 show that the number of hospital beds has a significantly positive association with the number of inpatient admissions per doctor ($p<0.001$) and occupancy rate ($p<0.05$). Lindrooth et al. (2003) indicated that occupancy rate is an important performance indicator of the hospital. Due to global budget compressions, a negative effect has been found between numbers of CT and physicians upon the number of inpatient admissions per doctor. However, no significant correlation has been found among beds, the number of CT, number of physicians and infection rate, nor among the numbers of CT, number of physicians and occupancy rate, revealing partial support for Hypothesis 1. This finding demonstrates that a larger number of hospital beds leads to an increase in the number of inpatient admissions per doctor and the occupancy rate. On the contrary, an increase in equipment/facilities and physicians results in a negative effect on the number of inpatient admissions per doctor.

4.2 Correlation between Competitive Strategy and Performance

Hypothesis 2 proposed that competition strategy is positively associated with hospital performance. In Table 2, the results of the main effects in model 2 show that cost-control competition has a significantly marginal effect on the number of inpatient admissions per doctor ($p<0.1$) and a positive effect on infection rate ($p<0.1$). These findings are similar to the conclusion of Tsai, Wu, and Pai's (2002) study. Surprisingly, we found that innovation competition has a significantly negative effect on the number of inpatient admissions per doctor. The possible explanation for the negative correlation is probably because that adoption of innovative technologies or services, such as body sculpture and laser photo-refractive surgery, which are provided for outpatient healthcare delivery, may consume much more efforts from doctors in inpatient healthcare delivery.

4.3 Correlation between Cooperative Strategy and Performance

Hypothesis 3 proposed that cooperation strategy is positively associated with hospital performance. In Table 2, the results of the main effects in model 2 show that governmental cooperation has a significant effect on the number of inpatient admissions per doctor ($p<0.05$). The findings imply that if hospitals assertively interact with governmental agencies, healthcare associations, and a medical specialist academy, which may lift the hospitals' image and reputation, hospitals may increase their exposure and attract more patients in the market; therefore the performance such as the number of inpatient admissions per doctor is improved. This is consistent with the arguments from Douglas and Ryman (2003) and Shortell et al. (2000). They indicated that with more inter-organizational linkages and higher status in a network, a hospital is able to attract physicians, patients and other resources more easily.

The above-mentioned results demonstrate partial support for Hypotheses 1, 2, and 3. Furthermore, Hypotheses 4 to 6 were proposed to examine how environmental uncertainty moderates the association between resource and performance, and the association between strategy and performance. According to the factor analysis, the environmental uncertainty can be classified

into environmental state uncertainty and environmental impact uncertainty. Regression analysis is used to examine the moderating effects of these two factors separately. Table 3 shows the results of the moderating effects.

4.4 Moderating Effect of Environmental Uncertainty on the Correlation between Resources and Performance

Hypothesis 4 proposed that the perceived environmental uncertainty will moderate the correlation between resource and hospital performance. In Table 3, the results of interaction effects show that the correlation between numbers of CT and the occupancy rate is stronger when hospitals perceived high environmental impact uncertainty ($p<0.05$). We also find that environmental impact uncertainty will strengthen the positive effect of the number of CT upon the number of inpatient admission ($p<0.05$). That is, when the regulations and policies made by the healthcare authorities are changing frequently and are unpredictable, more resources are needed to cope with external uncertainty and to generate better performance.

This is consistent with the concept that organizational slack plays the key role of being the buffer, while confronting environmental changes (Thompson, 1967).

4.5 Moderating Effect of Environmental Uncertainty on the Correlation between Competitive Strategy and Performance

Hypothesis 5 proposed that the perceived environmental uncertainty will moderate the correlation between competitive strategy and hospital performance. In Table 3, the environmental impact uncertainty has a marginally significant moderating effect on the relationship between innovation competition, and the number of inpatient admissions per doctor is stronger when hospitals perceive high environmental impact uncertainty ($p<0.1$). This implies that when hospitals perceive the great impact from healthcare regulations and national insurance policies, in order to cope with regulatory impact, hospitals should initiate more innovative strategies to create differentiation for generating better performance. Our finding is consistent with the study of Short et al. (2002). However, it is noteworthy that environmental uncertainty, either state uncertainty or impact uncertainty, reinforces the positive correlation between cost-control competition and infection rate.

Table 2. The Result of regression analysis

Variable	Infection rate		Number of inpatient admissions per doctor		Occupancy rate	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Intercept item	0.0252***	-2.670*	1891.249*	2666.592	0.597***	0.415***
	(5.956)	(-0.201)	(2.301)	(1.165)	(17.666)	(3.804)
Medical center	0.0169*	15.027	-0.002	177.339	0.106	0.119
	(2.069)	(1.219)	(-0.139)	(0.084)	(1.618)	(1.174)
Regional hospital	0.0012	13.668*	0.002	-1269.069	0.0072	0.058
	(1.013)	(2.184)	(1.275)	(-1.178)	(1.592)	(1.102)
Hospital beds		0.000		7.606***		0.001*
		(-0.036)		(6.174)		(2.346)
Numbers of CT		1.131		-1312.644†		-0.014
		(0.279)		(-1.883)		(-0.420)
Numbers of physicians		-0.068		-28.640*		0.000
		(-0.919)		(-2.242)		(0.087)
Innovation competition		-1.792		-1154.258***		-0.027
		(-0.585)		(-2.191)		(-1.032)
Cost-control competition		5.275†		871.123†		0.012
		(1.931)		(1.853)		(0.541)
Governmental cooperation		-1.297		963.640*		0.036
		(-0.480)		(2.075)		(1.610)
Industrial cooperation		-1.685		-768.165		-0.012
		(-0.060)		(-1.340)		(-0.127)
F value	6.266**	0.891	1.045	6.932***	6.701***	3.285***
R^2	0.120	0.063	0.046	0.342	0.129	0.200
Adjusted R^2	0.105	0.006	0.031	0.293	0.115	0.139

Note. n=130; The figure in the parenthesis denotes for t-value; † : $p<0.1$, * : $p<0.05$, ** : $p<0.01$, *** : $p<0.001$.

Table 3. The Result of interactive effect analysis

Variables	Performance		
	Infection rate	Number of inpatient admissions per doctor	Occupancy rate
Intercept item	-4.8720	1000.7654	0.4242*
	(-0.2270)	(0.2842)	(2.5680)
Medical center	14.7218	-105.8846	-0.0408
	(0.9340)	(-0.0409)	(-0.3359)
Regional hospital	15.4584*	-1289.2642	-0.0157
	(2.0801)	(-1.0571)	(-0.2700)
Hospital beds	0.0083	7.4279***	0.0003**
	(0.7202)	(3.9115)	(2.8200)
Numbers of CT	-0.9269	-2635.8787**	-0.0838*
	(-0.1791)	(-3.1035)	(-2.1080)
Numbers of physicians	-0.0798	-29.0483†	0.0001
	(-0.8869)	(-1.9666)	(0.0814)
Innovation competition	-1.7563	-1599.8138*	-0.0088
	(-0.4590)	(-2.5478)	(-0.2969)
Cost-control competition	6.3401†	1043.8706†	-0.0289
	(1.8322)	(1.8381)	(-1.0620)
Governmental cooperation	-1.0116	2362.4400***	0.0739*
	(-0.2429)	(3.4560)	(2.3030)
Industrial cooperation	-2.8223	-1437.4881†	-0.0202
	(-0.5652)	(-1.7542)	(-0.5276)
Hospital beds*Environment state uncertainty	-0.0464	-2.4429	0.0001
	(-1.5691)	(-0.5031)	(0.4248)
Hospital beds*Environment impact uncertainty	0.0057	2.1391	0.0002*
	(0.4572)	(1.0540)	(2.4620)
Numbers of CT*Environment state uncertainty	3.2692	-430.9262	0.0334
	(0.3776)	(-0.3033)	(0.4955)
Numbers of CT*Environment impact uncertainty	-1.8548	2628.1155*	0.0728
	(-0.2556)	(2.2065)	(1.3054)
Numbers of physicians*Environment state uncertainty	-0.0003	0.0001	-0.0000
	(-0.0012)	(0.0001)	(-0.0001)
Numbers of physicians*Environment impact uncertainty	0.1966	4.9259	-0.0009
	(1.3113)	(0.2002)	(-0.8130)
Innovation competition*Environment state uncertainty	-3.8097	-881.3513	-0.0096
	(-0.7701)	(-1.0856)	(-0.2386)
Innovation competition*Environment impact uncertainty	0.1847	1767.6890†	-0.0148
	(0.0316)	(1.8456)	(-0.3295)
Cost-control competition*Environment state uncertainty	-5.9444	464.6825	-0.0182
	(-1.2927)	(0.6158)	(-0.4928)
Cost-control competition*Environment impact uncertainty	3.9651	-367.6869	0.1004
	(0.7965)	(-0.4501)	(2.6199)
Governmental cooperation*Environment state uncertainty	6.1606	855.7274	0.0192
	(1.4860)	(1.2578)	(0.5964)
Governmental cooperation*Environment impact uncertainty	-3.3258	-3015.1536**	-0.1052*
	(-0.5459)	(-3.0159)	(-2.2461)
Industrial cooperation*Environment state uncertainty	3.5724	-314.0402	0.0000
	(0.8369)	(-0.4483)	(0.0014)
Industrial cooperation*Environment state uncertainty	-1.8591	1207.0803	0.0433
	(-0.2497)	(0.9880)	(0.7573)
F value	0.620	3.726***	2.423***
R^2	0.113	0.434	0.337
Adjusted R^2	0.006	0.317	0.198

Note. n=130; The figure in the parenthesis denotes for t-value; † : $p<0.1$, * : $p<0.05$, ** : $p<0.01$, *** : $p<0.001$.

That is, when hospitals perceive a higher environmental state and impact uncertainty, the adoption of cost-control competitive strategy may adversely increase infection rate, despite reducing the costs. It shows the high risk if hospitals focus too much on cost-control strategy, particularly when they perceive high environmental uncertainty.

4.6 Moderating Effect of Environmental Uncertainty on the Correlation between Cooperative Strategy and Performance

Hypothesis 6 proposed that the perceived environmental uncertainty will moderate the correlation between cooperative strategy and hospital performance. In Table 3, the results of interaction effects show that the environmental impact uncertainty has a significant negative moderating effect on the relationship between governmental cooperation and the number of inpatient admissions per doctor. This implies that when hospitals perceive the great impact from healthcare regulations and national insurance policies, in order to cope with the regulatory impact, hospitals should participate in inter-organizational cooperative arrangements with other hospitals, or also organizations in the upstream and downstream areas, for strategic alliances and networks to facilitate more patient referral between hospital and partners. Thus, the number of inpatient admissions per doctor can be increased. However, we also find the environmental impact uncertainty has a negative moderating effect on the relationship between governmental cooperation and occupancy rate. This can be explained by the fact that the more the hospitals perceive intensive environmental impact, the more they comply with healthcare regulations and policies such as the global budget and patient transferal system. Under the cooperation with governmental authorities, hospitals are supposed to dedicate more commitments (such as sparing more hospital beds) on taking care of serious cases such as SARS patients, which in turn leads to decrease in occupancy rate. As for the industrial cooperation strategy, we found no significant moderating effect of environmental state uncertainty on the relationship between industrial cooperation and performance.

5. Conclusion

This empirical study aims to examine how resources, competition and cooperation strategies affect hospital performance and how environmental uncertainty plays its moderating role on the relationship between resource, strategy, and performance. We found that: (1) hospital beds has a significantly positive effect on occupancy rate and number of inpatient admissions per doctor, but the number of CT and number of physicians have a negative effect on the number of inpatient admissions per doctor; (2) cost-control competition strategy has a significantly marginal effect on the number of inpatient admissions per doctor, but innovation competition strategy has a significantly negative effect on the number of inpatient admissions per doctor; (3) governmental cooperation has a significant effect on the number of inpatient admissions per doctor; (4) the correlation between hospital beds and occupancy is stronger when hospitals perceive high environmental impact uncertainty; (5) the correlation between the number of CT and number of inpatient admissions per doctor is stronger when hospitals perceive high environmental impact uncertainty; (6) the correlation between innovation competition strategy and the number of inpatient admissions per doctor is stronger when hospitals perceive high environmental impact uncertainty; and (7) the environmental impact uncertainty has a significant negative moderating effect on the relationship between government cooperation and the number of inpatient admissions per doctor and the occupancy rate.

Several limitations should be addressed. First, in this study pooling acute, chronic and special beds together as an indicator of hospital resources might obscure the true effects between the variables. Second, without careful adjustment on hospital case-mix, using infection rate as a performance indicator might be misleading. Third, although the ideal function of the hospitals is to take care of the hospitalized patients, the actual function and the main sources of the profits are from outpatient services in Taiwan. Therefore, the use of inpatient admissions per doctor as a performance indicator might not be most appropriate. However, in accordance with our findings, we propose the following implications for healthcare management practice.

Firstly, according to a resource-based view, hospitals should develop and invest their core competence and resource advantages for creating better performance. However, empirical study showed that the more investment in hospital beds, the higher the inpatient admissions per doctor and occupancy rate. This relationship is even stronger when hospitals perceive

higher environmental impact uncertainty. However, inversely, more investments in equipment, facilities and physicians did not increase performance but decreased the number of inpatient admissions per doctor. This reflects the investment dilemma for healthcare managers. Despite more hospital beds creating performance, more investment in physical assets and human resources come with expansion on hospital size, in terms of hospital beds, which arouses the tension of cost control that hospitals encountered, particularly under the global budget system. Therefore, stuck in the investment dilemma, hospitals should not consider only the resource investment in beds and equipment, but also the other managerial and organizational capitals such as compensation and a motivation system to improve the productivity of medical and non-medical staff.

Secondly, cost-control strategy has a positive effect on the number of inpatient admissions per doctor. However, we also found that the more cost control is emphasized, the higher the infection rate. We suggest that healthcare managers should periodically review the strength and weakness of resource advantages, and effectively deploy resources to fit the internal strategies and external changes to create performance. More importantly, over-focusing on cost-control strategy may increase the risk of raising the infection rate, which may in turn increase the cost on medical lawsuits. Healthcare and medical quality improvement is the key to healthcare operation and management, and hospitals should keep the balance between cost control and quality improvement to secure healthcare service deliveries rather than over-emphasis on cost control.

Thirdly, hospitals should be in compliance with healthcare regulations and policies, and conduct good interactive relationships with government agencies and healthcare associations. This study supports that governmental cooperation is positively correlated with the number of inpatient admissions per doctor. Regulatory changes have long been a dominant force in the healthcare sector (Begun & Kaissi, 2004). Under the national health insurance system and global budget, hospitals are unable to break free from regulatory control, but have to be in compliance with healthcare and insurance policies. Besides, the global budget is designed to be involved with more interaction between and among healthcare providers for resource allocation and distribution. These pressures force hospitals to become more efficient by engaging in various inter-organizational cooperative strategies (Baxter, Levin, Legaspi, Bailey, & Brown, 2002). Therefore, good relationships with governmental institutions, healthcare associations, and medical specialist academies may enhance the interaction with those organizations, which may further facilitate the negotiation for the global budget to assure hospitals' survival. Yet, we found when hospitals perceive a higher environmental impact, the positive relationship between government cooperation and performance diminishes. As we argued above, the stronger the hospitals' perceived environmental impact is, the more they cooperate with governmental agencies and comply with regulations, and the more commitments hospitals are required to dedicate, which in turn leads to worse performance. This implied that when cooperating with government institutions, hospitals should keep a balance between compliance with policies and commitment in such cooperation relationships.

Fourthly, hospitals should monitor the external environmental changes, initiate innovative healthcare services, and participate in industrial collaboration with other hospitals and organizations in both upstream and downstream areas. Although there exists a negative relationship between innovation competitive strategy and the number of inpatient admissions per doctor, contrarily, environmental impact uncertainty has a significant positively moderating effect on the relationship between innovation competitive strategy and the number of inpatient admissions per doctor. This implies that despite over-use of innovation strategy which may hinder performance, after all the niche in the healthcare market is limited, particularly when the external impact from the national healthcare insurance is intensive. However, adoption of innovative services and diversification into non-national-insurance market may create another market niche when the healthcare environment is hostile.

In short, this study examines the fundamental issues of how resources, strategy, and environment affect hospital performance. We proposed six hypotheses to depict the relationships between and among constructs. We then discussed the implications according to our research findings. Theoretically, this study contributes to understanding more on competition and cooperation strategies in the healthcare industry. Practically, this study provides implications on how hospitals should create better performance by resources and strategies under the environmental uncertainty. Hopefully, this research will

shed light on the strategic management research in the healthcare industry and contribute more insight for healthcare practitioners to formulate and implement their competition and cooperation strategies.

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