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Construction and Evaluation of Physician Assessment Indicators

Yung-Hsiang Lu*, Chieh-Hsiang Lu**, Ming-Shian Lin**, and Hsin-Pei Yu*
National Chiayi University No.580, Sinmin Rd., West Dist., Chiayi City 600, Taiwan, ROC
*Ditmanson Medical Foundation Chiayi Christian Hospital, No.539, Zhongxiao Rd., East Dist., Chiayi City 600, Taiwan, R.O.C.***

Abstract

This study aimed to determine the performance a physician on the basis of it is vision and strategies, by integrating BSC approach with ANP method. Proposed structure based on the past literature relates to medical management and interview with experts specialize in this field. In identifying the related strategic objectives and evaluation indictors of BSC activities for the proposed framework for the physician performance assessment, ANP method was applied, too.

Keywords: Physician Assessment Indicators

1. Background and Objectives

National Health Insurance was implemented in Taiwan in 1995. The payment system is based on fees for services; therefore, hospitals are encouraged to expand their medical services to generate more income. However, financial difficulties have led to crisis in health care, prompting the government to implement payment by case and a global budget. These policies have had a profound influence on the management of medical institutions. At the same time, demographic changes have increased the dependence of the population on the medical system, particularly among the elderly. In this kind of competitive environment, hospitals must strive to improve the quality of the services they provide, while adhering to an appropriate, fiscally responsible business model.

Previous researchers have outlined the difficulties involved in measuring the performance of hospitals. One factor that makes such measurements difficult is that the financial information related to hospitals is not open to scrutiny. This has led to the adoption of data envelopment analysis (DEA) and other methods to assess the operations and business performance of hospitals. Chen, Cheng, & Hsu (2008) used DEA to investigate the status of medical institution and utilization of hospitals. This research covered 42 hospitals, including those operated by the Department of Health as well as facilities run by city governments, and other contracted hospitals. Because it is a multi-dimensional construct, no single indicator can be used to estimate hospital performance (Gruca & Nath, 1994).

Many factors must be taken into account in the evaluation of investment performance and the efficiency of resource utilization. To achieve these ends, Kaplan & Norton (1992) proposed the Balanced Scorecard (BSC). BSC is a conceptual framework for translating an organization's strategic objectives into performance measures distributed among four perspectives: financial, customer, internal business processes, and learning and growth. BSC can be used to assess an organization according to internal, external, past, future, subjective and objective factors. The main purpose of performance evaluation is to assist in the development and adoption of a mission, strategies, and vision. Performance evaluation must be based on objectively verifiable constructs; therefore, this study combined the BSC approach with other management systems to ensure the highest performance.

Regardless of the industry (service or manufacturing), the main objective in organizational restructuring and enterprise reform is the improvement of quality and enhancement of performance. Staff efficiency is a key factor influencing the performance of an organization; therefore, human evaluation indicators can provide guidance in the development of a business strategy and the achievement of business objectives. Enhancing the performance of an organization also requires excellent management methods. In medical institutions, physicians work closely with the patients; however, previous studies have failed to assess individual indicators when evaluating physicians. Wu (1999) claimed that ensuring quality and reaching goals requires good indicators as the core elements in evaluation. Thus, this study applied BSC to establish indicators as a benchmark for the performance of physicians.

This study focused on the performance of physicians specializing in internal medicine in a teaching hospital in Taiwan. We conducted face to face interviews with ten experts from Chung Shan Medical University, China Medical University, Chang Gung Medical Foundation, and Tzu Chi Hospital to assemble indicators and confirm their validity, based on their subjective experiences (Henderson, 1991). We then calculated the weight of each indicator and arranged them in order of importance.

2. Research purposes

This study adopted BSC, and ANP to investigate which strategic objectives or evaluation indicators have more impact to physicians. BSC can help everyone in an organization understand and work toward a shared vision and use the available resources more efficiently. The purposes of this study were as follows: First, construct strategic objectives and evaluation indicators by reviewing previous literature and ensure them through interviewing with experts. Second, using ANP to calculate their weights and arranged them in order of importance.

3. Methods

3.1 Balanced Scorecard (BSC)

The Balanced Scored method was introduced by Kaplan & Norton (1990). It is a performance evaluation system made especially for 12 companies in America and the concept of BSC was pointed out in Harvard Business Review. It implemented into a wide range of areas such as manufacturing, services, heavy industries, high-tech industries and nonprofit organization etc. The BSC approach comprises four perspectives, there are financial perspective, customer perspective, internal business perspective, and learning and growth perspective. The development

of BSC in the early stages only consider a non-financial indicators. So far, BSC has attracted increasing attention in the world and has been promoted widely. It is therefore a very important strategic management tool which helps an organization not only to measure performance, but also manage the strategies needed to be adopted so that the long term goals are achieved(Sharma,2009). In short, BSC evolved into a set of system that integrate and assist the organization in the effective implementation of strategies (Niven, 2002). The content of four perspectives of BSC are described as follows:

1) Financial perspective

Kaplan & Norton (1996) divided organization's life cycle into three stages, there are growth, maintenance and harvest period. However, in different stages of the organizations may pursue different financial goals. The evaluation indictors usually contain operating income, operating costs, return on investment, net profit rate, cash flows, etc. Finally, project profitability focuses on the project as the basic unit for planning and control, while sales backlog helps reduce performance uncertainty (Kaplan & Norton, 1993). In this study, we set that physicians pursing to increase operating revenue as their strategic objective.

2) Customer perspective

In customer perspective, companies must separate customers and market segmentation to distinguish the differences with the competitors. Kaplan & Norton (1996) proposed that the core measurements include market share ratio, acquirement of customers, continuation of customers, customer satisfaction, and profitability of customers. In this study, we set that when constructing physician assessment indicators, the strategic objectives are explore the source of patient, maintain patient loyalty and promote customer satisfaction.

3) Internal business perspective

Internal business means that enterprises must have their own core competencies or a unique style in a highly competitive market environment. Kaplan & Norton (1996) considered that main goal in this perspective is to achieve financial and customer perspectives' objectives. Besides, Kaplan & Norton (1996) divided organization value chain activities into high level process areas, including innovation process, operating process, and after-sales service. In this study, we set that enhance the quality of personal services, provide multidisciplinary medical services, enhance hospital business processes, and create reputation of hospital as physician's strategic objectives.

4) Learning and growth perspective

Due to the competitive environment, if organizations want to have sustainable operation and development, they should rely on continual innovation and growth. Kaplan & Norton (1996) considered the core measurement of this perspective are employee satisfaction, the abilities of employees, and employee continuation rates etc. Among them, the most important strategic objective is employee satisfaction, which is regarded as a force to improve employee productivity and continuation rates. In this study, we set cultivate professional training knowledge, enhance research and innovation capacities, and enhance teaching and training capacities as physician's strategic objectives.

BSC in this study is divided into four perspective follow by Kaplan & Norton (1996). BSC not only gives us a valuable tool for enabling employees to understand the company's situation, but also helps organization to measure their performance. In this study, our main propose is to construct physician assessment indicators. Therefore organizations here mean to physicians. We hope to construct physician assessment indicators to let physicians understand their working strategies. Then work towards a shared vision. Furthermore, the hospital will provide much better quality services to patients, or earn more operating revenues.

3.2   Analytic Network Process (ANP)

Saaty (1996) proposed the concept of an Analytic Network Process (ANP), a generalization of Analytic Hierarchy Process used to deal with problems associated with dependence and feedback in which the structure of decision-making is not linear. This approach uses feedback to replace the proposed hierarchical network, both of which adopt a systematic approach to decision-making. The purpose is to obtain the ratio scale and predict all of the guidelines, objectives, and relationships between programs. ANP considers dependencies between guidelines and the standards are not as strict as those in AHP, making it applicable in a wider range of decision-making problems. Finally, ANP takes into account the relevance of various groups, so it is in keeping with the facts.

The primary feature of ANP is the use of a supermatrix, which confirms organizational goals, guidelines, and the priority of alternative projects. Supermatrix is a combination of multiple sub-matrices formed by the interaction of eigenvectors among each of the elements. A reading of zero in the supermatrix is an indication that the groups or elements are independent; i.e., no interactions. The supermatrix can be used to assess outer dependencies (the interaction between groups) and inner dependencies (occurring in the same group). In the event of dependence between elements in the matrix, $\lim_{k \to \infty} A^{2K+1}$ returns a fixed value. Normalizing the value and let sum of the weights get 1 in each series (Saaty, 1996). In sum, the advantages of the ANP to integrate their mutual effects through a single logical procedure include using a hierarchical decision network to incorporate dependencies and feedback, to represent and analyze interactions (Sarkis & Sundarraj, 2002).

The four steps in the construction of ANP are as follows:

1) Establish the structure of the network hierarchy:

In this step, the problem should be explain clearly and be resolve into a reasonable system, like a network. This network structure can be obtained by group through discussing or other appropriate methods. This group must include a wide variety expertise expert. Each expert has different influence on the results, so the weights determine by the experts.

2) Pairwise comparison matrices and priority vectors:

The elements are compared with each other elements. The way of conducting pairwise comparisons and obtaining priority vectors is the same as AHP. The relative importance values are determined on a scale of 1~9, where a score of 1 indicates equally important; 3 indicates weakly more important; 5 indicates strongly more important; 7 indicates very strongly more

important; 9 indicates extremely more important. A reciprocal value is assigned to the inverse comparison. $a_{ij} = 1/a_{ji}$ where a_{ij} denotes the importance of the ith element compared with the jth element. Besides, priority vectors can be derived as an estimate of the relative importance associated with the elements or clusters compared by solving the following equation: $A\overline{w} = \lambda_{max}\overline{w}$ (1) where A is the matrix of pairwise comparison, w is the eigenvector, and λ_{max} is the largest eigenvalue.

3) Supermatrix formation:

The priority vectors are entered into the appropriate columns of a supermatrix. A supermatrix is a partitioned matrix where each segment represents a relationship between two clusters. The supermatrix of a system of N clusters is denoted as the following:

$$
w = \begin{array}{c} \\ c_1 \\ \\ \\ \\ \\ c_k \\ \\ \\ \\ \\ c_N \end{array}
\begin{array}{c}
e_{11} \\ \vdots \\ e_{1n_1} \\ \vdots \\ e_{k1} \\ \vdots \\ e_{kn_k} \\ \vdots \\ e_{N1} \\ \vdots \\ e_{Nn_N}
\end{array}
\begin{bmatrix}
w_{11} & \cdots & w_{1k} & \cdots & w_{1N} \\
\vdots & & \vdots & & \vdots \\
w_{k1} & \cdots & w_{kk} & \cdots & w_{kN} \\
\vdots & & \vdots & & \vdots \\
w_{N1} & \cdots & w_{Nk} & \cdots & w_{NN}
\end{bmatrix}
\quad (2)
$$

where the column headers are $c_1 \cdots c_k \cdots c_N$ and $e_{11}\cdots e_{1n_1}\cdots e_{k1}\cdots e_{kn_k}\cdots e_{N1}\cdots e_{Nn_k}$

4) Final priorities:

As the supermatrix covers the whole network, the finial priorities of elements are found in the corresponding columns in the limit supermatrix. And then we can select the best alternatives or list important sequence.

3.3   Interview with experts

There are two main purpose to interview with experts. This study applies interview with experts to obtain important factors, which cannot just by reviewing literature. First, to understand what experts thought about measurement perspectives, strategic objectives and evaluation indicators building in this study; that is to say, to ensure our structure is correct. Second, to distinguish which strategic objectives or evaluation indicators is the most significant to physicians. Through interview with experts to ask them to answer ANP questionnaire, then integrate all the

information and calculate their weights.

By face to face interview, interviewer triggered interviewees to provide some information, or to express their views and ideas on certain issues. Interviewees are required to talk about the issue or topic what interviewer proposed (Henderson, 1991). Therefore, we interviewed with ten experts who is specialize in medical field. In order to increase the credibility in our study, each expert should have manage experience in medical center, teaching hospital or teaching in medical university. In sum, by interview with experts to obtain the correct information or understand the interviewee's views on performance assessment indicators, attitudes and feelings.

4. Results

This study through reviews BSC literature and interviews with experts to build three hierarchies, including measurement perspectives, strategic objectives and evaluation indicators. We apply Analytic Network Process(ANP) to integrate different expert questionnaires and calculate their relative weights. First, we use geometric mean method to integrate ten questionnaires. And then enter the result of 10 expert questionnaires into Super Decisions to calculate comparison matrix. Next it follows to comparison matrix to build supermatrix. Finally, we can know each levels relative weights.

In order to ensure the logic of this study, we further assess the consistency(C.I.) of the evaluation indicators. And the result of our study shows that each measurement perspectives, strategic objectives and evaluation indicators C.I. are less than 0.1. They conform that an acceptable standard C.I.$\leqq$0.1 (Saaty, 1996); That is to say, each measurement perspectives, strategic objectives and evaluation indicators we propose in this study are consistency. Fig.1 show each strategic objectives and evaluation indicators relative weights and sequence.

In financial perspective, the strategic objective of this study is to increase operating revenue. Because there is only a strategic objective in the financial perspective, its weight is 1.000. Evaluation indicators are following: average number of visits by National Health Insurance (NHI), average number of visits (fee required), teaching revenues and research project revenues. Among them, the average number of visits (NHI) weights up to 0.503. The order of the average number of visits (expense) is 0.309, research projects revenue is 0.099 and teaching revenue is 0.089.

In customer perspective, the strategic objective of this study is to explore the source of patients, maintain patient loyalty and promote customer satisfaction. The highest relative weight is "promote customer satisfaction", it accounts for 0.506. And followed in sequence are maintain patient loyalty and explore the source of patient, their relative weights are 0.274 and 0.220. So we can see that the physicians care about promoting customer satisfaction. When physician assessing their performance, "promote customer satisfaction" this objective is the most importance. Besides, average number of outpatient is the most important in explore the source of patient part, its weight is 0.533; patient return visit ratio (> 2 times) is the most important in maintain patient loyalty part, its weight is 0.483. In promote customer satisfaction part, its order of importance are physician professional competence, physician service competence, and caring competence. The highest weight is 0.263.

In internal process perspective, the order of strategic objectives are enhance hospital business processes, its weight is 0.415; enhance the quality of personal services accounted for 0.222; multidisciplinary medical services weight is 0.184; create reputation of hospital weight is 0.179. In enhance the quality of personal services part, the most important is physician visit time; in multidisciplinary medical services part, the most important is interdepartmental medical services; in enhance hospital business processes part, the order of are served as department director, director of subspecialty and deputy director; in create reputation of hospital part, the most important indictors is served as ministry of Health and Welfare' committee or another organizations members.

In learning and growth perspective, the strategic objective of this study is cultivate professional training knowledge, enhance research and innovation capacities and enhance teaching and training capabilities. Among them, cultivate professional training knowledge is the most important. And enhance research and innovation capacities' weight is the lowest.

However, in cultivate professional training knowledge part, participants of the seminar times its weight up to 0.256; in enhance research and innovation capacities part, number of journals published is the most important, its weight is 0.572; in enhance teaching and training capabilities part, served as the teachers of ministry of education.

In short, when physician assessing performance indicators, the strategic objectives in the customer perspective promote customer satisfaction as the most important; in internal process perspective, enhance hospital business processes its weight is the highest; in learning and growth perspective, cultivate professional training knowledge is mainly important. The other hand, the most significant indicators are the average number of visits (NHI), average number of outpatient, patient return visit ratio (> 2 times), physician professional competence, physician visit time, multidisciplinary medical services, served as director, served as ministry of Health and Welfare or another organizations members, participants of the seminar times, number of journals published, the teachers of ministry of education.
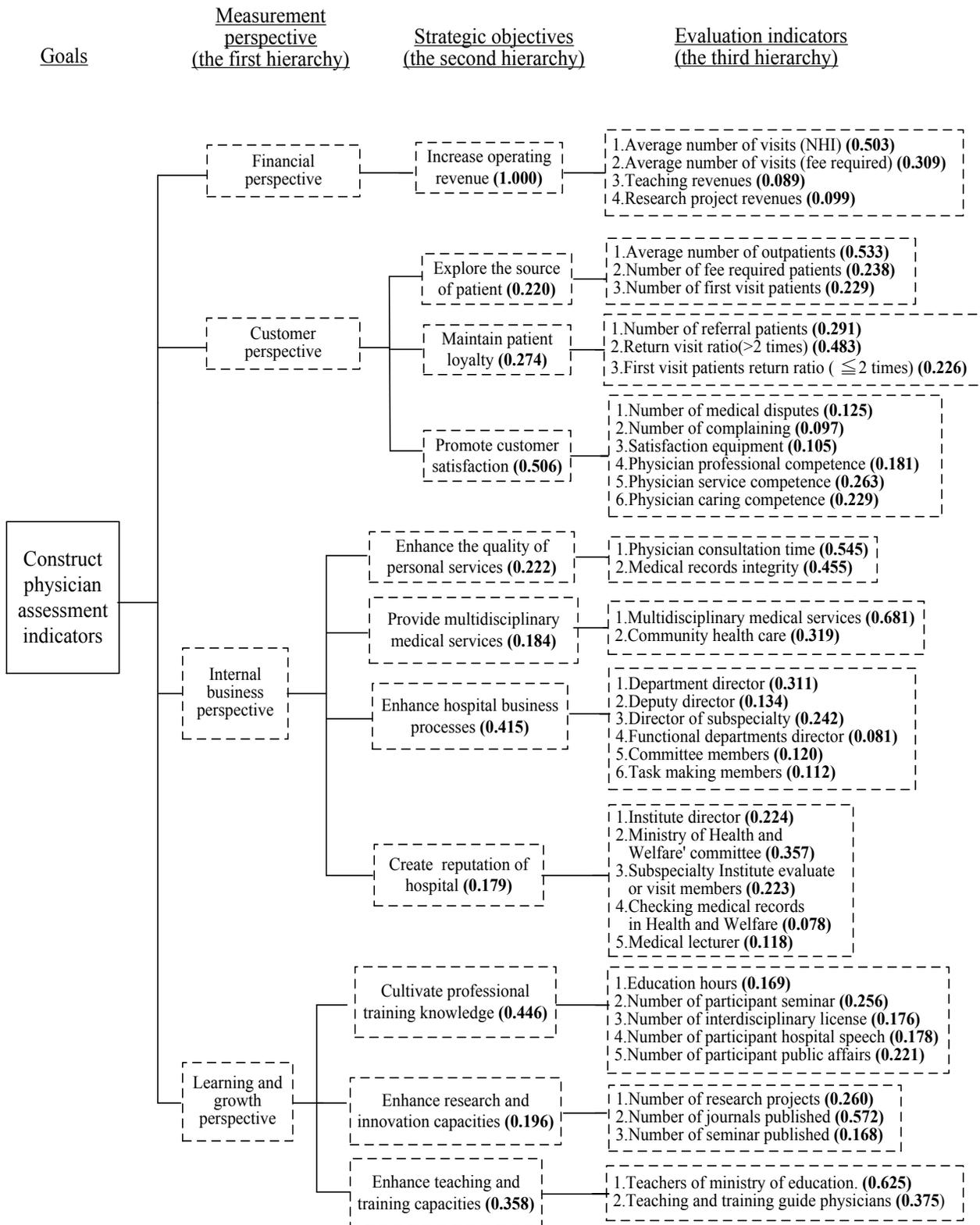
Goals	Measurement perspective (the first hierarchy)	Strategic objectives (the second hierarchy)	Evaluation indicators (the third hierarchy)

Construct physician assessment indicators

Financial perspective — Increase operating revenue (1.000)
1.Average number of visits (NHI) (0.503)
2.Average number of visits (fee required) (0.309)
3.Teaching revenues (0.089)
4.Research project revenues (0.099)

Customer perspective

Explore the source of patient (0.220)
1.Average number of outpatients (0.533)
2.Number of fee required patients (0.238)
3.Number of first visit patients (0.229)

Maintain patient loyalty (0.274)
1.Number of referral patients (0.291)
2.Return visit ratio(>2 times) (0.483)
3.First visit patients return ratio (≦2 times) (0.226)

Promote customer satisfaction (0.506)
1.Number of medical disputes (0.125)
2.Number of complaining (0.097)
3.Satisfaction equipment (0.105)
4.Physician professional competence (0.181)
5.Physician service competence (0.263)
6.Physician caring competence (0.229)

Internal business perspective

Enhance the quality of personal services (0.222)
1.Physician consultation time (0.545)
2.Medical records integrity (0.455)

Provide multidisciplinary medical services (0.184)
1.Multidisciplinary medical services (0.681)
2.Community health care (0.319)

Enhance hospital business processes (0.415)
1.Department director (0.311)
2.Deputy director (0.134)
3.Director of subspecialty (0.242)
4.Functional departments director (0.081)
5.Committee members (0.120)
6.Task making members (0.112)

Create reputation of hospital (0.179)
1.Institute director (0.224)
2.Ministry of Health and Welfare' committee (0.357)
3.Subspecialty Institute evaluate or visit members (0.223)
4.Checking medical records in Health and Welfare (0.078)
5.Medical lecturer (0.118)

Learning and growth perspective

Cultivate professional training knowledge (0.446)
1.Education hours (0.169)
2.Number of participant seminar (0.256)
3.Number of interdisciplinary license (0.176)
4.Number of participant hospital speech (0.178)
5.Number of participant public affairs (0.221)

Enhance research and innovation capacities (0.196)
1.Number of research projects (0.260)
2.Number of journals published (0.572)
3.Number of seminar published (0.168)

Enhance teaching and training capacities (0.358)
1.Teachers of ministry of education. (0.625)
2.Teaching and training guide physicians (0.375)

Fig.1 the framework of physician assessment indicators

5. Conclusion

This study aimed to determine the performance a physician on the basis of it is vision and strategies, by integrating BSC approach with ANP method. Proposed structure based on the past literature relate to medical management and interview with experts specialize in this field. In identifying the related strategic objectives and evaluation indictors of BSC activities for the proposed framework for the physician performance assessment, ANP method was applied, too.

Compared with the previous literature, this paper has the following contributions. First, a new model for measuring physician's performance based on BSC has never been found in the previous studies. In the previous studies relate to the performance in hospital usually applied whole hospital or a department as a unit, not one adopted physician as their units. Second, this study presented an integration of two of the most popular methods used for organizational performance evaluation: the BSC and the ANP. But this study extend to performance evaluation in physicians. Moreover, the four perspectives offers a framework for translating strategic objectives into performance measurements. Measuring the effects of implemented strategies and providing feedback on the performance of strategic activities (Bergen & Benco, 2004).

In this study, the significant strategic objectives to influence physician performance are: promote customer satisfaction (0.506), enhance hospital business processes (0.415), and cultivate professional training knowledge (0.446). It means that physicians emphasizes on providing high quality service to the customers to increase their satisfaction. And physician service competence (0.263) is the greatest impact factor. Besides, enhance hospital business processes may lead internal business perspective performance getting well. Among them serve as department director has more influence than others senior official in groups. Finally, cultivate professional training knowledge is also important to physician performance. There are five evaluation indicators to assess cultivate professional training knowledge. Among them, number of participant seminar (0.256) is the greatest impact indicators. However this study provide a reference when assessing physician performance in the future.

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