

Optimal selection of location for Taiwanese hospitals to ensure a competitive advantage by using the analytic hierarchy process and sensitivity analysis

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Abstract

Implementation of the National Health Insurance scheme in Taiwan since 1995 has intensified competition in the local medical sector. Given elevated living standards island wide, Taiwanese residents have become more health conscious and attach increasing importance to quality healthcare, explaining the heightened consumer demand in the quality and scope of medical services. Additionally, the medical service sector has improved its organizational structure and encouraged hospitals to establish management practices that would increase their competitiveness. In such an intensely competitive environment, selecting the optimal location of hospitals to be established is of priority concern. Therefore, this work presents an analytic hierarchy process (AHP)-based evaluation model. Sensitivity analysis is performed in detail by varying the objective factor decision weight, the priority weight of subjective factors and the gain factors. Adopted herein is the renowned diamond model introduced in Porter's *The Competitive Advantage of Nations* (1990) that influences how competitive advantages, especially with respect to developing and evaluating the objectives of optimal location selection, are related in order to devise a standardized operational procedure. Besides a literature review and interviews with experts, this study also adopts the modified Delphi method, the AHP and the sensitivity analysis to develop an evaluation method for selecting the optimal location of a regional hospital in Taiwan to determine its effectiveness. The proposed evaluation criterion provides a valuable reference for hospital administrators and academics in establishing a standardized means of selecting the optimal location for new medical care facilities.

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1. Introduction

Implementation of the National Health Insurance scheme in Taiwan since 1995 has intensified competition in the local medical sector. Given elevated living standards islandwide, Taiwanese residents have become more health conscious and attach increasing importance to quality healthcare, explaining the heightened consumer demand in the quality and scope of medical services. Additionally, the medical service sector has improved its organizational

structure and encouraged hospitals to establish management practices that would increase their competitiveness. In such an intensely competitive environment, selecting the optimal location of hospitals to be established is of priority concern. In its early stage, linear programming was used to solve location-selection-related problems [1]. For instance, previous studies attempted to locate the optimal position to establish a hospital by utilizing conventional mathematic or statistical methods. In considering where to select a location, besides legislation restrictions, policymakers and business groups seldom consider how selecting the optimal location during the decision-making process could possibly affect its competitiveness.

A healthcare program was launched in 1984 to offer medical resources throughout Taiwan proportionately. The

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Department of Health of the Executive Yuan divides 63 sub-regions into 17 medical areas, with each sub-region to contain a certain number of hospitals, as planned in advance in order to continuously improve healthcare services and living standards. According to the Department of Health, while 18,777 hospitals were operating in 2003, that figure increased to 19,240 in 2004, i.e., an annual increase of more than 2.47%. Additionally, the global aging phenomenon is no exception in Taiwan, with the island officially becoming a rapidly aging society in 1993 according to the World Health Organization definition. Therefore, from a market-demand perspective, Taiwan has enormous growth potential, as evidenced by the establishment of many hospitals and the increasing competitiveness in the medical care sector. Given the oversaturated and fiercely competitive medical service sector, selecting the wrong location for a new hospital could significantly raise operational costs and stymie future growth.

Selecting the optimal location for a hospital in terms of competitiveness involves the various hospital types in Taiwan, devising appropriate evaluation criteria and categorizing hospitals according to those evaluation criteria.

Location theory has been extensively studied [2]. Despite the considerable attention paid to selecting an optimal location for medical care facilities, establishing a hospital must strictly comply with governmental regulations, often causing decision makers to overlook the importance of selecting an optimal location. Sensitivity analysis is performed in detail by varying the objective factor decision weight, the priority weight of subjective factors and the gain factors. This study adopts the renowned diamond model introduced in Porter's *The Competitive Advantage of Nations* (1990) that influences how competitive advantages, especially with respect to developing and evaluating the objectives of optimal location selection, are related in order to devise a standardized operational procedure. Besides a literature review and interviews with experts, this study also adopts the modified Delphi method, the analytic hierarchy process (AHP) and the sensitivity analysis to develop an evaluation method for selecting the optimal location of a regional hospital in Taiwan to determine its effectiveness. The proposed evaluation criterion provides a valuable reference for hospital administrators and academics in establishing a standardized means of selecting the optimal location for new medical care facilities.

2. Literature review

2.1. Porter's diamond model

Porter's diamond model comprises six elements; four country-specific determinants and two external variables, i.e., chance and government. Porter's four determinants and two outside forces interact in the diamond of competitive advantage, with the global competitiveness of a country, depending on the type and quality of these

interactions. According to Porter, the four determinants for a nation "... shape the environment in which local firms compete and promote or impede the creation of competitive conditions [19]." The four determinants are the following:

1. *Factor conditions*: production-related factors of a nation, including natural resources and created factors, e.g., infrastructure and skilled labor
2. *Demand conditions*: domestic demand for certain products or services
3. *Firm strategy, structure and rivalry*: rivalry among domestic firms and the conditions influencing how companies are created, organized and managed and
4. *Related and supporting industries*: the presence or absence of supplier and related industries that are globally competitive.

Porter's two external forces, i.e., chance and government, offer contrasting approaches. Government obviously influences the competitiveness of a nation. For instance, a government can penalize foreign firms either through tariffs as a direct entry barrier or through subsidies as an indirect strategy – both of which provide domestic firms with short-term competitive advantages. Whereas such discriminatory governmental measures shelter domestic firms; doing so prevents the development of sustainable (long-run) competitive advantages.

While certain components of Porter's diamond model are unoriginal, the model accurately focuses on the strategies of firms rather than those of countries. Porter states, "... firms, not nations, compete in international markets" In terms of creating firm-specific linkages between the four determinants and the two external forces, Porter's model is useful and, potentially, an accurate predictor of future trends. However, Porter's policy recommendations restrict a government's industrial and strategic trade policies instead of opening markets to foreign investment without arbitrary restrictions.

2.2. Location theory

As location selection theory emerged, Weber [4] proposed the position problems of a factory. Early location theory focused mainly on the production of raw materials and selling to markets in order to determine a factory's optimal position by minimizing transportation costs.

Plant location research can be categorized into three perspectives such as: (a) prescriptive, i.e., how to make plant-location-related decisions; (b) nation-based, i.e., what a nation should do to attract overseas firms to locate domestically; and (c) customer-based business, i.e., what criteria are adopted to make plant-location-related decisions. Decision-making criteria for plant locations are

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